Pdl 14/58

The Southern Forest Rangers College Magazine

Vol. 34 APRIL 1958 No 2

The Southern Forest Rangers College Magazine
Quarterly Journal of Forestry, Shikar and Travel

The Magazine now forms a section of the Southern Forest Rangers College and Regional Foresters School Association. The Editorial Board has been reconstituted and the Management Rules revised in terms of the Rules of the Association.

EDITORIAL BOARD

Chairman : — Shri Dr. D. A. Rama Rao, B. Sc., A.I.I.Sc., M. F. (Wash) Ph. D., Principal

Editor : — Shri S. V. Venkataramanan, B. A., M.F.S., Instructor

Joint Editor : — Shri T. R. Somasundaram, B. Sc., Curator

Student Editors : — Shri C. K. Karunakaran, B. Sc.
,, P. Srinivasa Reddy, B. Sc.

Student Secretaries : — Shri M. K. Divakaran Nair
,, T. R. Govindaswami

REPRESENTATIVES

Senior Rangers Class : — Shri S. P. Sankara Reddy, B. Sc.

Junior Rangers Class : — ,, P. A. Abdul Bari, B. Sc.

Regional Foresters School : ,, P. Satyanarayana

MANAGEMENT RULES:

1. **Life Membership:** Rs. 200/- or more.

2. **Subscriptions:** Subscriptions shall be for a year from July to June, as follows:—

For Officers drawing a Salary of Rs. 100/- and above, Rs 6/- per annum.

,, Less than Rs. 100/-, **Rs.** 4/- per annum.

The Editorial Board is authorised to revise the rate of subscription from time to time. The subscription should be sent in advance or paid by Banker's Order system to the Joint Editor, Southern Forest Rangers College Magazine, R. S. Puram P.O., Coimbatore.

Ordinarily, the Editor will inform the members three months before the expiry of the subscription. If no intimation is received by him regarding continuation or otherwise of the membership, the July issue will be sent by V. P. P.

3 **Correspondence:** Correspondence regarding subscription, advertisement and other financial matters should be addressed to the Editor, Southern Forest Rangers College Magazine, R. S. Puram P. O., Coimbatore.

4. **Contributions of articles:** Contributions should be sent to the Editor.

5 The Editor will not be responsible for the opinions expressed in articles other than the Editorial. The Editorial may not be the opinion of the Editorial Board.

6. Articles connected directly or indirectly with forestry will be accepted. Articles on other subjects can be considered according to their utility and the space available.

Articles should be legibly written in ink or preferably typed with double spacing on one side of foolscap page, leaving a margin of 1½ inches, and be **accompanied by summaries.**

Contributors are requested to sign their contributions and clearly state their name, place of residence and occupation.

7. **Reprints:** Contributors can be supplied free of cost SIX reprints of their articles together with any illustrations, provided the articles are two pages or more in length and the Editor is informed. Contributors desiring extra copies should intimate the Editor the number of copies required. They will be charged the actual expenditure incurred on them.

8. **Payment:** No payment will be made for contributions to the Southern Forest Rangers College Magazine.

9. **Free Membership:** The Magazine offers free membership for ONE YEAR ONLY to any contributor, other than the students of the Southern Forest Rangers College, who contributes the largest number of accepted articles to the Southern Forest Rangers College Magazine.

10. **Prizes:** The following prizes will be awarded annually to the students of the Southern Forest Rangers College:—

(a) for the best article, adjudged by a special committee constituted for this purpose, published in the Magazine.

(b) for the largest number of articles published in the Magazine.

The special Committee shall consist of:

(i) The President, F. R. I & Colleges, Dehra Dun, (ii) The Principal, Southern Forest Rangers College, Coimbatore and (iii) The Editor, Southern Forest Rangers College Magazine.

Pdl 14/58

THE

Southern Forest Rangers College Magazine

Published Quarterly

Vol. 35 **APRIL 1958** **No. 2**

N. B:— Contributors are requested to send in their contributions written legibly in ink on one side of the paper only or in type-script.

About Ourselves

Tours: The Senior Ranger classes were out on tour from 21-1-58 till 27-2-58. They camped in Madras, Bapatla, Hyderabad, Allapalli, Balharshah, Agra, Haldwani and New Forest, and had a very varied and strenuous programme of excursions. Their study included methods of regeneration and management of cashew (*Anacardium occidentale*) and *Casuarina equisetifolia* on the east coast, teak (*Tectona grandis*) in South Chanda (Bombay) and sal (*Shorea robusta*), chir (*Pinus roxburghii*) and miscellaneous species in Uttar Pradesh, afforestation methods in coastal sands of Andhra, denuded areas in Hyderabad and Agra and *tarai* and *babhar* tracts in Uttar Pradesh, the management and working problems of mangrove forests in Andhra coast, coppice-with-reserves working in North Chanda (Bombay), timber depots in Madras and Balharshah, resin-tapping of *chir* in Nainital, Turpentine factory at Bareilly, Kondapalli toy industry, research in progress in the different branches of the Forest Research Institute, etc. As in the two previous years, the meet with the Senior Rangers of the Northern Forest Rangers College was organized at Allapalli. Besides a joint symposium, a round of matches in volley ball, foot-ball and hockey were played. The 'A' Division of the Northern College won the Director of Forest Education's prize, reversing the result of last year in which this College had won.

The Junior Ranger classes were on tour from 21—1—58 till 25—2—58. They camped in Calicut, Parappa, Makut and Kannoth. The tour was directed mainly to the study of forest management under West Coast conditions, viz., hot, humid, wet climate with laterization of the soil as a perpetual danger on exposure. The climax rain forest and its regression types, methods of natural and artificial regeneration of evergreens, raising of teak (*Tectona grandis*), cashew (*Anacardium occidentale*), *Ailanthus malabarica*, *Salmalia malabarica*, *Evodia roxburghiana*, *Artocarpus hirsuta*, *Swietenia macrophylla*, *Hopea parviflora*, *Cinnamomum zeylanicum*, etc., selection, shelterwood and clear-felling systems of working, methods of felling, conversion and extraction of timber, forest and sea-side depots, etc., were studied. The Kohinoor Saw Mills and the Western India Plywood Factory at Baliapatam, the Kulshekar Cashew Factory at Mangalore, and a Tile Factory, an Umbrella Handle Factory and the Kallai Standard Furniture Works at Calicut were visited.

The Regional Foresters Class was on tour from 17-1-58 till 28-2-58, camping in Bangalore, Tiruchirapalli and Walayar. At Bangalore the class had its field engineering training and rifle training with the Sappers and Miners and visited, besides, plantations of *Eucalyptus* hybrid, *Casuarina* and *Bursera delpechiana*, sandal forests, the Hindustan Aircraft and Coach Factory, Commercial Union Plywood Factory, the Forest Research Laboratory, etc. From Tiruchirapalli the class visited plantations of teak, casuarina, cashew and miscellaneous species. At Walayar, the students were examined in practical survey.

Extra-Curricular Activities: The Republic Day was celebrated in a fitting manner on 26—1—58 in headquarters as also in the respective camps of the Classes on tour.

A film show with 16 M. M. films of educational interest was held on 10-3-58.

Shri M. Krishnan, the well-known naturalist and journalist and a member of the Indian Wild Life Board, delivered three lectures on the 15th, 17th and 18th March, the first a general lecture on *The Importance of Wild Life and Its Preservation*, the second on *The Wild animals of*

India and the third on *The Identification of Birds in the field.* On 17-3-58 Prof. B. G. L. Swamy of the Presidency College, Madras, gave an interesting talk to the students on "Aid to field identification of flora".

Visit of the President: Shri R. N. Dutta, I. F. S., the President of the Forest Research Institute and Colleges, Dehra Dun, inspected the College, the Museum and the estate on 13—1—58 and examined the proposals for incorporating the Zonal Research Wing in the College estate.

Sports and Games: The following matches were played during the year at headquarters:

Cricket

				Result.
(1)	Southern Forest Rangers College	*Vs.*	R. S. Puram Cricket Club	Lost
(2)	,,	*Vs.*	P. S. G. College of Technology	,,
(3)	,,	*Vs.*	Madras Agricultural College	Won
(4)	,,	*Vs.*	Gopalapuram Club	Lost

Hockey

(1)	Southern Forest Rangers College	*Vs.*	Madras Agricultural College	Drawn
(2)	,,	*Vs.*	P. S. G. College of Technology	Lost
(3)	,,	*Vs*	Madras Agricultural College	Lost
(4)	,,	*Vs.*	,,	Drawn
(5)	,,	*Vs.*	Government Arts College	Won
(6)	,,	*Vs*	Government Polytehnic	Won
(7)	,,	*Vs.*	P S. G. Arts College	Won
(8)	,,	*Vs.*	P S. G. College of Technology	Drawn
(9)	,,	*Vs.*	Coimbatore Institute of Technology	Won
(10)	,,	*Vs.*	Government Arts College	Won

Volley Ball

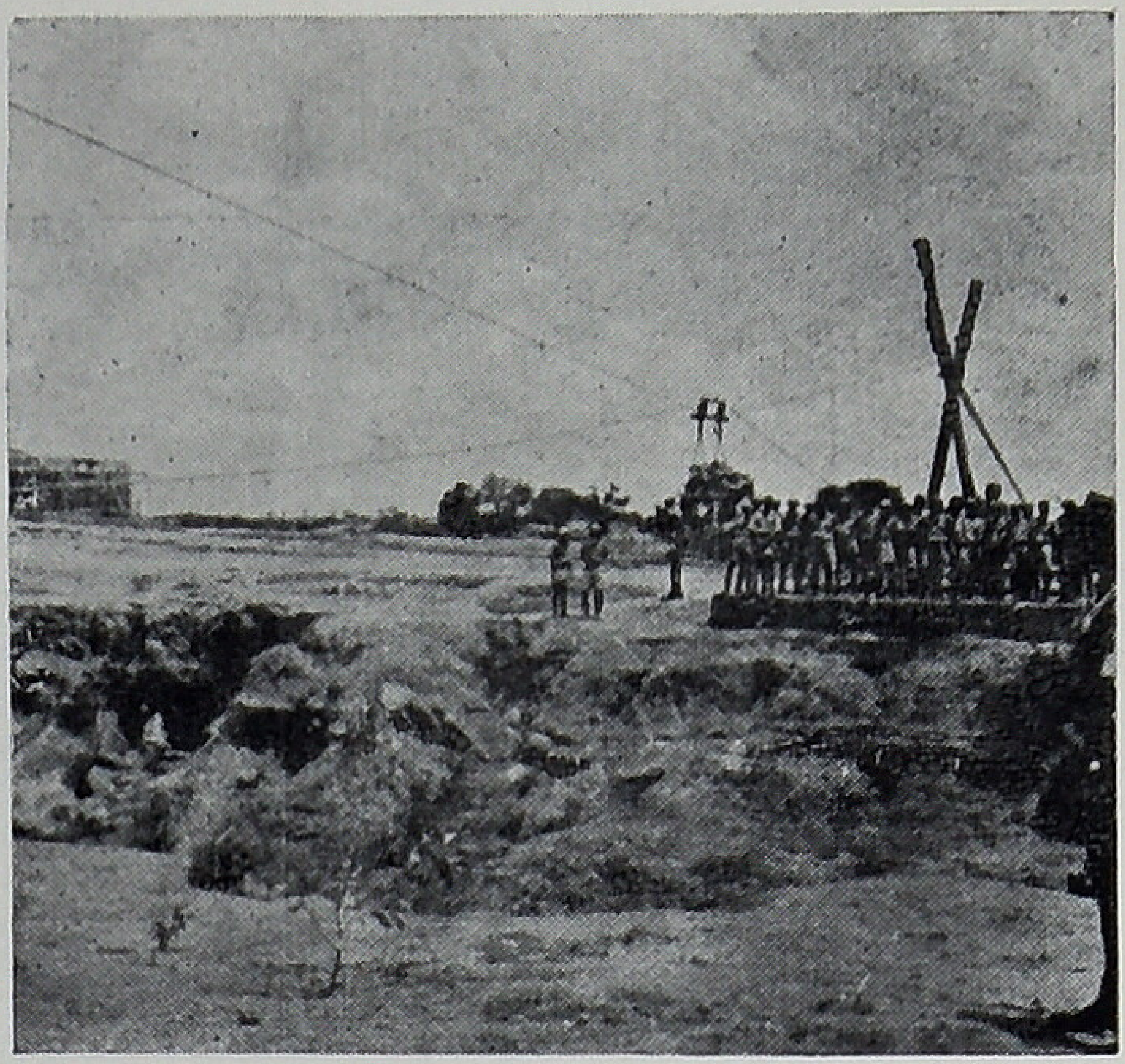
(1)	Southern Forest Rangers College	*Vs.*	Madras Agricultural College	Won
(2)	,,	*Vs.*	Govt. Polytechnic	Won
(3)	,,	*Vs.*	Maruthi College of Physical Education	Lost
(4)	,,	*Vs.*	Madras Agricultural College	Won
(5)	,,	*Vs.*	Govt. Polytechnic	Won
(6)	,,	*Vs.*	Madras Agricultural College	Won
(7)	,,	*Vs.*	Maruthi College of Physical Education	Lost
(8)	,,	*Vs.*	Government Arts College	Lost
(9)	,,	*Vs.*	Government College of Technology	Won

Basket Ball

(1)	Southern Forest Rangers College	*Vs.*	Government College of Technology	Lost
(2)	,,	*Vs.*	Madras Agricultural College	Lost
(3)	,,	*Vs.*	P. S. G. College of Technology	Lost

Foot Ball

(1)	Southern Forest Rangers College	*Vs.*	Government College of Technology	Won
(2)	,,	*Vs.*	Govt. Arts College	Lost
(3)	,,	*Vs.*	Madras Agricultural College	Won
(4)	,,	*Vs.*	Coimbatore Institute of Technology	Lost
(5)	,,	*Vs.*	Madras Agricultural College	Lost



Students erecting an aerial ropeway at Bangalore.

Kusum trees (*Schleichera oleosa*) after harvesting lac.

—*Photos by K. G. George.*

A view from chaliam Timber Depot

—*Photo by C. Pratap Reddy*

A view across the Nainital lake

Katha manufacture as a cottage industry in Uttar Pradesh

—*Photos by Ramakrishnalal.*

Pole-vault champion, student Ekbote in action, at the Annual Athletic Meet. (December '57)

—*Photo by T. R. Somasundaram.*

A 'Serambi' structure, Kalhalla, Coorg

—*Pnoto by K. Karunakaran Nair. (January '56)*

1954 Wattle plantation with a wind belt of Bluegum

—*Photo by T. R. Somasundaram. (18—5—'56)*

During the tour in the north, the Senior Rangers Class played a number of matches in hockey, volley ball and foot-ball at Bapatla, Allapalli and New Forest with local teams. The strain of the journeys and excursions was apparently too much for them for, excepting for two matches in hockey in which they drew and one in volley ball which they won, they lost in all the others.

The following are the results of the matches played among the different Houses of the College:

Hockey:	Winner	—	Venkateswara Iyer House
	Runner up	—	Venkatarama Iyer House
Foot Ball:	Winner	—	Raghavan House
	Runner-up	—	Chengappa House
Volley Ball:	Winner	—	Venkateswara Iyer House
	Runner-up	—	Muthanna House
Cricket:	Winner	—	Muthanna House
	Runner-up	—	Chengappa House
Basket Ball:	Winner	—	Raghavan House
	Runner-up	—	Muthanna House

In Student Rajeswaran (Andamans) of the Junior Rangers Class, the College has a really top-class volleyball player. He made a name playing for the Friends Union in the local Bhawmik Postal Recreation Club Tournament between 26-10-57 and 3-11-57. With 27 teams participating, the Friends Union won the trophy and Sri Rajeswaran, along with other members of this team, got the individual cup for winners. So much did he impress by his splendid game that, perhaps for the first time in the annals of this College, he was invited by the Coimbatore Athletic Association (with which the College Athletic Club is associated) to play for their team in the Madras State Volley Ball Tournament in December 57. After defeating the Abhiramapatnam Volley Ball Club in good style, the team lost to " Tajmal " A. Though his team could not win the championship, Shri Rajeswaran has acquitted himself very well indeed, and we wish him the best of luck. It is a great pity that we do not have more students of his calibre in games.

The annual Marathon Race covering a track of 7 miles was held on 5-4-58. 150 Students participated. Student Prajapati of the Senior Rangers Class won it with a lead of furlongs in one of the best performances in the history of the race in this College. The following were the first five runners—

1	Shri M. C. Prajapathi (Central Soil Conservation Board)	... 42 Min.	8 Seconds
2	,, S C. Saxena (Madhya Pradesh)	... 45 ,,	55 ,,
	,, H. S Willie (Ceylon)	... 46 ,,	37 ,,
4	,, P. A. Kuttikammad (Kerala)	... 47 ,,	20 ,,
5	,, L. G. Kulkarni (Bombay)	... 48 ,,	20 ,,

Gass Forest Museum: The following exhibits were added to the Museum during the quarter ended March 58.

S. No.	Reg. No.	Date of receipt.	Particulars of Specimen.	Source.
			WILD LIFE	
1	681	31—3—58	Flying Squirrel (*Petromys orál*)	Coimbatore.
2	682	,,	The Common or Fantail snipe (*Capella gallinago*)	,,
3	683	,,	Jack snipe	,,
4	684	,,	The Common Pariah Kite (*Milvus migrans*)	,,
5	685	,,	Spotted owlet (*Athene brama*)	,,
6	686	,,	White-breasted King fisher (*Halcyon smyrnensis*)	,,
7	687	;,	Shikra (*Astur badius*)	,,

S. No.	Reg. No.	Date of receipt.	Particulars of Specimen.	Source.
			MISCELLANEOUS	
8	679	17—2—58	Board inlaid with veneers of walnut, mahagony, venteak, Burma teak, C. P. teak, white cedar, poon and rosewood.	Mysore Commercial Union, Ltd., Yesvantpur, Bangalore.
9	680	28—2—58	Box Containing 24 Kondapalli toys	Kondapalli.

Special Number: We take this opportunity to remind our readers of our appeal in our last issue for contribution of articles on *Forest Grazing and Fodder* to our July 1958 Special Number. As this has to be published in the last week of June 1958, the articles shall have to be sent to the press by the third week of May 1958. We shall be grateful, therefore, if the contributions reach us by the 15th May. Articles received after the 22nd May may have to be kept over for publication in later issues.

— S. V. V.

Our Wild Life and its Preservation

By

M. KRISHNAN

(This is the first of a series of three lectures delivered by Sri Krishnan, well-known writer, artist and naturalist, on March 15th, 17th, and 18th this year. The other two lectures on wild animals and birds will be published in the coming issues of this Magazine. — Ed.)

I have been asked to address you on three days on our wild life and the problems of wild life preservation in our country. I am happy to have this opportunity and thank you for it. Today I shall tell you, in a general way, about our flora and fauna and their decline, and how we can save them for the future. During the past few years, considerable interest has been evinced in our country on this question.

The term 'wild life' connotes all living things that have not been domesticated, that is, the natural plant and animal life of any country. This term is used to distinguish wild animals from domesticated live-stock, and has also been used, unfortunately, to distinguish nature from mankind. The idea that we are an entity apart from nature, and that we do not belong to animate creation because we have developed a way of life and a culture of our own is incorrect and unscientific, but unfortunately it has gained ground. Many of our most eminent men have asked, "Why do we want the preservation of wild life in our country, when we have no food for the human population ?" The justification of wild life conservation, advocated by some in answer to this question, betrays our belief in our segregation from the rest of creation even more clearly than the question- The justification has been on the basis of the utility of animals to huma. nity, in providing meat and pelt and tanned hide, and the value of insectivorous birds to agriculture! Our wild life has been justified purely on an utilitarian basis.

I feel no such justification is necessary — moreover, it is incorrect from a biological standpoint. It is natural for us to take an interest in the plant and animal life around us, since we belong as much to creation as they do — it is natural for us to feel a curiosity towards them, and to find a very real satisfaction and joy in studying them. In Western

countries, after the recent ruinous World War, popular interest in natural history has been widely stimulated, and in the past decade, when book production has been much more difficult than in the past, more books on plants and animals have been published than in the entire century preceding. More than one naturalist has commented on this in the preface to his book, and pointed out that his book has been possible in spite of rising costs only because of the great revival of popular interest in nature, because people cannot afford costlier pleasure today and have turned to the inexpensive pastime of nature study, only to find it most unexpectedly rewarding, and all-absorbing. India is blessed with one of the richest floras and faunas in the world, and even if we can develop no great popular feeling for this wealth of nature in our lifetime, it is our duty to save this heritage for the next generation.

There has been a sad decline in the numbers and species of our wild animals in the past fifty years or so. Shikar books, and natural history books, written in the early years of this century bear testimony to the abundance of our forests and wild animals. However, during the past fifty years, these have dwindled everywhere, and in places have disappeared altogether. When we say an animal is extinct, we mean that it has died out entirely in the country, but in a more restricted sense it may become locally extinct, it may die out in an area where it was long known. That sort of local extinction of wild life is now only too common, in many places.

In 1942, when I went to live in the area, the country around the Tungabhadra Dam held plenty of blackbuck, chinkara, leopards, hares, partridges and other creatures of the open country — I have seen the Great Indian Bustard, now on the verge of extinction, here. These animals had lived there for centuries, as the marvellously depictive hunting scenes carved on the stone of Hampi can testify. But today, as your Principal can tell you, there is nothing there — the entire plant and animal life of the area has been wiped out, due to the sudden increase of the human population — some thirty thousand labourers were brought into the area to build the dam, and a large permanent population settled around the project, with the result that the wild life of the place was completely devastated.

Before going on to the problem of preserving what there is left of our heritage of nature, we might as well look into the causes for the decline of wild life in our country. It is popularly thought that the gun and rifle, and the snare or the gipsy poacher, have contributed most to this decline. No doubt the gun and the snare are ultimately responsible for the animals of any area dying out, but the main cause is something more insidious and unpreventable, the alarming increase in our population, and the need to find more agricultural land, more fuel and timber, and more transport routes for this growing population. Just think, since the recent partition of the country, the population of our Republic alone has exceeded the population of what was formerly India, India and Pakistan put together! We have encroacbed everywhere on the teritory of wild animals, our scattered smoll holdings have used up the land, and our cart-tracks and rural roads have cut it up, till the animals had no space to live in, or freedom from disturbance — we have felled forests and cleared the scrub for our agriculture and for firewood till the birds and beasts had no cover, and the land was completely denuded–it is no wonder that with the rapid increase in our population, and our needlessly wasteful methods of coping with increasing demands, the wild life has dwindled to this extent. Those who travel by air can have a very fair idea of this wasteful spread of effort–the earth below is dotted with scattered holdings and intersected by a needless profusion of tracks and roads.

Even avenues in cities and towns, and along the arterial roads, which offered so much scope to bird life, have been cut down for firewood. Thirty years ago, when I was a student, Mylapore in Madras City was rich in shady avenues and grassy fields and woodland — today it is a completely built up area, and where I had formerly seen even jackals and hares, you can see nothing wilder than palm-squirrels now. The splendid bird life of the locality has also declined very considerably.

Another cause for the decline of the wild life of a country is the introduction of exotic species. Luckily, we have not made the mistake of introducing foreign animals into India — they have done so elsewhere, and regretted it. In Australia, for example, they introduced the rabbit from England—and the rabbit multiplied rapidly to become

one of the chief menaces to agriculture in that country. In other countries, too, similar disastrous introductions have been made, but we have not made this mistake so far, except in the Andamans. Some years ago, feeling that only the beautiful Chital could complete the sylvan loveliness of the Andamans, some one imported a few Chital from the mainland and released them in the forests. With no enemies to check their spread, the deer multiplied rapidly to become a serious threat to the forests of the Andamans, and the Government of India was forced to send two female leopards to the islands, to try and keep down the numbers of the deer. Note how cautiously the move was made — two female leopards were sent so that the leopards could not multiply and constitute a fresh threat in themselves*!*

However, while our fauna has not been affected by exotic introductions, our flora has changed entirely over large tracts due to such introductions. I was sorry to note, as I came in to Coimbatore, that you, too, had not escaped the *Prosopis.* Many plants from Tropical America have overrun the Indian scrub and jungles, and become so firmly established here that it would now be pedantic to talk of them as exotic species. You all know how common a feature of our scrub and wastelands the prickly-pear was, till it was decided to kill it off by introducing the cochineal insect. The *lantana,* the finest example of a plant distributed by animal agency, made the swiftest conquest of India known to history — it was imported all the way from South America into Ceylon by an enthusiastic gardener, as a novelty, and in no time at all it had spread all over Ceylon, and then all over India. No successful method of discouraging the lantana has been found, although it is a serious threat to forestry and agriculture all over India, and is useless to humanity. However, it is a fact that the lantana is a blessing to our wild life: It provides them cover where otherwise there would be no cover; and many birds and beasts relish its fruit.

The lantana was not introduced intentionally into India, but *Prosopis juliflora,* that has now conquered South India and many places in the North, including Delhi, was not only introduced by man, but actively encouraged by governments. Some of us protested against the introduction of this ugly and useless exotic, while it was being

introduced; I was among the earliest to object to it. I suppose now that it is there, the only thing to be done is to try and get rid of it somehow.

Among other common tropical American plants domiciled in India, and now quite a feature of our wastelands and scrub, I should mention *Argemone mexicana, Croton sparsiflorus, Tridax procumbens, Alternanthera echinata* and *Gomphrena decumbens*.

From a book on forestry that I read recently I learnt that in England, during the latest World War, when the demand for timber was most acute, it was from private forests that this demand was mainly met, and that even during the emergency the government insisted that there should be adequate plantation to offset the loss in woodland due to the cutting down of timber trees in private forests. We have few private forests, and even in State forests, the afforestation work, or compensatory plantation done, is never adequate to offset the cutting of wood for timber and fuel. Some of our forests are not forests at all, but merely stony hills covered with boulders and thorn-bushes, though classified as Reserve Forest. The great decline in woodland and forests has certainly been one of the causes for the dimunition of our wild animals.

Another thing that strikes me is that in no Indian language is there a reliable natural history. Natural history, or any detailed information on our animal and plant life that is scientific and trustworthy, simply does not find a place in our traditional culture, oral or written. The only peeple who have any reliable lore about wild animals are the gipsies and others who snare, trap and hunt animals for a living. There is a very real need to create a popular feeling for wild life in our country.

The last cause I should mention is the non-enforcement of protective laws. There have always been such laws, but rarely has an offender against them been brought to book, particularly if he is an iufluential or rich man. We blamed the British for this laxity, and for the decline in our wild life, but what have we done to tighten up protective laws in the past ten years? Very little, I am afraid.

It is not enough to protect animals on paper, by gazette notification, or to broadcast protective laws by beat of tom-tom. Protective laws should be strictly enforced and offenders punished, regardless of their status. But of course, it is easy to make this criticism, but difficult to enforce protective laws. Unless there is efficient executive action, backed by public support, such laws are of no great use.

You may ask, 'What should we *do* to preserve our wild life? The answer is admirably brief. Do nothing. That is the secret of all wild life preservation—leave nature to herself, and you may trust her to look after herself much better than you can. This is what is implied in the phrase, the Balance of Nature. The best thing to do is leave well alone, not to interfere. All that we need do is to ensure that the wild life has adequate room to live in, and to enforce protective laws strictly.

However, many unexpected problems may arise in wild life preservation work. I would like to mention an example, from Ludlow Griscom's book, MODERN BIRD STUDY. Brown pelicans used to nest in large numbers on an island near the east coast of Florida, and in due course this island was declared a sanctuary, and notices put up all around it prohibiting people from entering the area or molesting the nesting birds in any way. Immediately the birds abandoned the island, and ceased to nest there. They had been frightened off by the boards meant specially for their protection!

Ecology of Natural Grasslands

By S. V. VENKATARAMAN, B. A., M. F. S.

(Note : This article is part of the note on the forest side written by the author in 1952—53 for use in the preparation of the Indian Council of Scientific Research Scientific Monograph No. 22, "The Grassland and Fodder Resources of India", by Dr R. O. Whyte of the F A. O., published in 1957. The earlier part appeared in PP. 21 to 32 of the January 1958 issue of this Magazine.)

Summary : *The ecological status of forest grasslands, the ecological significance of grazing in forests, parallelism between grassland and forest types, grasses as site indicators, indicators of heavy grazing incidence, grass-lands and biotic factors and the use of these factors in organizing forest grazing is discussed.*

(i) **The Ecological Status of grasslands:** Grassland is land in which grasses constitute the predominant, though not the exclusive, vegetation. Often enough, other plants and trees are also found in grasslands. In this sense, much that is called forest in many parts of India is really grassland (1). When grasses cease to predominate and trees get the upper hand, we have the woodland or forest. Only as extreme types do we have grasslands without any trees and woodlands without any grasses. Deserts also contain some degraded woody and herbaceous growth and, depending on whether the woody species or the grasses predominate, may be regarded as the lowest form of woodland or grassland (2).

We have hardly any artificial grassland in our country—certainly none in the forests—but our grasslands are not wholly natural either. In an indirect way they owe their existence to human activities. The consensus of opinion among ecolgists is that but for the lopping, shifting cultivation, burning and grazing practised through the ages in the forests, we should be having no grasslands as such in India.

It is inferred from studies of past climates and community migrations that while during moister periods of long duration the deciduous forests extended far into grasslands and the grasslands into deserts, the converse happened during similar dry periods (3). Deciduous forest

thus holds a post-climax relationship to grassland, of which desert is the pre-climax (4). As a climax formation, therefore, grassland is intermediate in status between forest or woodland on the one hand and desert on the other.

In India, however, while woodland and desert occur as formations, grassland does not seem to. In the opinion of Bor, for areas of any size, the climate in India is either a forest climate or a desert climate (5). Champion also has expressed doubts as to the existence in India of any examples of tropical climax grassland, though grassland is common enough in the seral stage and may even be sometimes a very stable " pre-climax " under the influence of fire and grazing. He has pointed out that the typical savannah type which occurs as a climatic climax elsewhere is as such apparently absent and that in the absence of biotic influences, the closed deciduous forest grades into thorn forest without an intermediate open park-like stage (6).

Grasslands may be locally found as an edaphic climax on wet soils and frost holes in the sal belt and in the hills elsewhere frost and excessive moisture inducing a "grassy climax"(7), but these circumstances can hardly make them a climatic climax. Lower alluvial deposits carry extensive grasslands. Some of these are believed to be a stage in the primary succession, particularly those in the wetter and drier sites which trees cannot colonize. *Saccharam spontaneum* dominates the beginnig of primary succession on sandy alluvial deposits. More generally, however, the grasslands on the lower alluvial deposits are the result of burning, felling and grazing Grasslands on the higher alluvium are also biotic in origin, being the result of human settlement and distruction of forest. The re-establishment of the forest is prevented by fire, grazing and deteriorated soil. Extensive areas in the sal belt which have suffered this treatment in the past carry now heavy savannah grasses—e. g., the higher *phantas* of *Kheri* and *Chaors* of Haldwani in Uttar Pradesh (7). There are extensive grassy downs on the Nilgiri, Palni and Anamalai plateaus in the South. Grazing and burning have been regularly practised in these grasslands. Discussing the ecology of the Nilgiri grasslands, Ranganathan has argued that even more intensive grazing and burning elsewhere have not produced similar grasslands; that these grasslands owe their origin to

frost as a master climatic factor and that, therefore, they should be considered as a climatic climax, sharing that status with the local *sholas* (8). As against this view, Bor has contended that once the existence of grazing and burning is admitted, the term *climatic climax* cannot be applied to the community under any system of terminology and that these grasslands can only be considered a biotic climax (9). Holmes considers that grasslands in Ceylon—which have much in common with those in India—are also "secondary and of biotic origin, arising from clearing, burning and cultivation and, later, after abandonment, by periodic burning" (10).

We shall, therefore, be justified in concluding that grasslands do not occur as a climatic climax in India, that they generally represent stages in secondary seres and rarely also priseres and that, wherever they are relatively more stable, they constitute a biotic climax or, in Clementsian terminology, a disclimax—more often of the nature of a serclimax than of that of a subclimax—maintained under the influence of fire and grazing.

(ii) **The ecological significance of grazing in forests:** Human activities have played a very important part in moulding forest types. Fire, shifting cultivation and grazing are three forms of such activities. All the three tend to have a desiccating effect on the forest and help to hold back succession at an earlier stage. The importance of this will be appreciated if it is realized that our economically important forests are all in the seral stage and that our wet evergreen forests—the types to which alone we can concede a definite climatic climax status–contain few economically important species and are not economically of importance. Champion observes, " Forest management consists largely in maintaining a forest in seral stage in which it is economically most valuable and that is relatively rarely the climax stage " (6). By and large, our teak (*Tectona grandis*) and Sal (*Shorea robusta*) forests are seral types, as also forests of most other valuable species.

Next to fire, grazing is probably the most influential factor governing the distribution of forest types and, as with fire, regulated grazing is to be considered a useful aid to natural regeneration. It helps to reduce undergrowth, expose mineral soil and mix it with humus, and trample the seed into the soil. When the grass growth is too

heavy, grazing tends to make it light and thereby reduces fire risk. In the case of Sal (*Shorea robusta*), Chirpine (*Pinus roxburghii*) and Deodar (*Cedrus deodara*), well distributed controlled grazing has been known to promote regeneration. Teak is not browsed ordinarily and, eherefore, in a grazed forest teak has fewer competitors and is tnabled to grow better (7). Ranganathan has drawn attention to the important role played by grazing in the ecology of the valuable sandalwood forests, by its keeping down grass and thereby saving from fire the extremely fire-tender sandal (11). Rowntree has recommended heavy grazing in areas where sal regeneration has proved refractory (12). He has also found that, under conditions of grazing restricted to winter, Simul (*Salmalia malabarica*) regeneration is greatly encouraged in parts of Assam (13). It has been reported from Coorg that fairly heavy grazing in certain waste lands resulted in profuse regeneration of *Pterocarpus marsupium* and teak (*Tectona grandis*) (14). Kartar Singh has observed that over-protection of the Deodar forests has resulted in heavy undergrowth and deep accumulation of humus, which have inhibited natural regeneration, and has therefore suggested that grazing should be allowed in forests of the Deodar working circle in the Dalhousie Range forests of Chamba States (15). Gresswell has remarked with reference to coniferous forests that, where weed growth is excessive, grazing to moderation is likely to prove a beneficial and not an injurious factor (16). In lower Bashahr Division of Himachal Pradesh, Kail (*Pinus excelsa*) regeneration in burnt areas has been greatly assisted by light grazing (17). In Yeotmal Division of Madhya Pradesh, grazing is reported to have played a great part in the reclothing of blanks in the poor quality teak forests by the removal of the heavy grasses and the encouragement of teak reproduction (18). Aggarwal has observed that grazing probably does more good than harm in areas subject to heavy weed growth by keeping down grass and herbage and reducing fire hazard. He has pointed out the different effects of grazing on different aspects in Kulu forests: while on the south to southwest aspects grazing effectively prevents Deodar regeneration, on the north to north-east aspect it considerably encourages regeneration (19). Similar instances of the beneficial effects of grazing can be multiplied. Not unoften, therefore, forestry practice in India as elsewhere uses controlled grazing as a silvicultural technique.

It must, however, be stated that often—and always when uncontrolled—grazing tends to be harmful to forests. In circumstances such as those referred to above, its use serves to make over-moist localities drier so as to accommodate certain economically important non-hygrophilous plants and to lessen fire-risk in areas carrying rank growth of grasses. In localities already none too moist, grazing hardens the soil, lessens aeration, upsets the soil-water regime, increases run-off and risk of erosion and throws back the succession through progressively deteriorating stages. Woody growth is replaced by more and more inflammable grass and thus the stage is prepared for the entry of fire. Forest fires are largely associated with grazing. The rank grasses have to be fired in order that the resulting tender shoots might provide some grazing. With progressive depletion of edible grasses and fodder species, non-palatable species capable of putting up resistance against grazing take the field. Species repelling browsing by the presence of tannin as in teak, acrid juices as in *Rhus*, *Aegle* and species of *Apocynaceae*, thorns as in *Randia* and *Acacias* and sour smell as in *Holarrhena* and *Holoptelia* occupy the ground (7). The forest is reduced to the open thorn-scrub type, and erosion starts. Browsers greatly accentuate and accelerate the denudation. A combination of goats, sheep, camels and cattle may convert a forest into a desert (5).

(iii) **Parallelism between grassland and forest types:** Two ways in which parallelism between grassland and forest types has been conceived or can be conceived are discussed below. In either case, the subject has not been studied in India in sufficient scientific detail.

Hole appears to have been the first to discuss the question of parallelism between woodland and grassland in India(2). He has mentioned parallel succession as one of the types of succession and cited as example *munj* (*Saccharum munja*) savannah existing as a parallel to woodland of *Acacia catechu*, *Dalbergia sissoo*, etc., under similar conditions. His thesis is that types of both grassland and woodland are found in all kinds of habitats, ranging from the most xerophytic to the most hygrophytic, that, as a rule, for every type of grassland there is a corresponding type of woodland thriving under similar environmental conditions and that changes from a grassland type to a corresponding woodland type and *vice versa* can be effected

easily and rapidly. As an example of parallel succession, he has cited the case of *munj* colonizing an area of recent alluvium and subsequently yielding place to a pure crop of *Khair* (*Acacia catechu*), the 'corresponding' woodland type. Following up the idea he has evolved a scheme of classification in which the "Dry Deciduous" forests and the Steppes, the "Deciduous" and "Hill" forests including the majority of coniferous forests, and the "Meadow" or "Moist Savannah", and lastly the "Tropical Evergreen" forests and the "Wet Savannah" and "Reed Swamp" from the three groups of parallel woodland and grassland types of vegetation corresponding to "xerophilous", "mesophilous" and "hygrophilous" habitats, the two types in each group being mutually exchangeable. Troup has subscribed to Hole's thesis, and has referred to certain grassland types and "parallel Woodland formations": *munj* (*Saccharum munja*) and *khair* (*Acacia catechu*); *Narenga porphyrocoma* (*Syn. Saccharum narenga*) and sal (*Shorea robusta*); and *Saccharum procerum, Phragmites karka*, etc., and *Albizzia procera, Bischofia javanica* and *Salmalia malabarica* (20).

Ecology has progressed since Hole's days and there is a good deal in his thesis that we cannot now accept. Hole, for example, thought in terms of even the climax formation in any site being either a grassland or a woodland, a possibility refuted by modern ecologists [(3), (4) and (21)]. Even in respect of the seral stages, the implied suggestion of identity or atleast close similarity as regards environmental conditions obtaining in different sites colonized by "parallel" woodland and grassland types and in the same site when a "parallel succession" takes place in it is unsustainable. In a forest climate edaphic conditions favourable to the growth of only grasses may sometimes result in the initial formation of grassland, but such conditions are usually only transitory as the grasses contribute to their own undoing by adding humus to the soil and thereby inviting tree species to supplant them (22). Grasses may predominate in a forest climate as a result of biotic factors also, but once these factors are kept out soil changes occur which pave the way for the elimination of the adventitious grasses and their replacement by tree growth. In either case, soil changes mark the transition from one to the other and it is difficult to imagine how grasslands in a forest climate can exhibit any consistent parallelism with woodlands in

different developmental stages in the full range of environmental conditions. In classifying the areas as 'xerophilous', 'mesophilous' and 'hygrophilous' and assigning the 'parallel' woodland and grassland types to them, Hole has equated in terms of climate only and not allowed sufficiently for edaphic variations.

Parallelism between grasslands and woodlands may, however, be conceived in a different light. Stages in primary and secondary successions in a forest climate are likely to be marked by parallelism between the tree dominants on the one hand and the associated chief grasses on the other. The grassy undergrowth of a forest with open canopy must be different from that of a closed canopy forest, and Bor considers that in all these habitats, the grass covering appears to be in harmony with the surroundings and is relatively stable as long as growing conditions are unaltered (22). This suggests that each forest type should carry certain grasses corresponding to its tree dominants. If so, a knowledge of tree dominants and associated chief grasses would prove invaluable for purposes of grazing-management in forests. Data of grasses found in forests are, however, rather meagre. Champion's valuable book on forest types (6), which contains detailed information of dominant trees, contains very little about grasses. With information gathered from this book a tabular statement of forest types, tree dominants and associated chief grasses has been prepared, and pending a detailed botanical survey, further information about grasses has been obtained from a number of States for incorporation in the the statement. Definite study of such parallelism as obtains between trees and grasses in forests should, however, await the completion of the grassland survey of India by the Indian Council of Agricultural Research.

(iv) **Grasses as site indicators:** It follows from the idea of parallelism between tree dominants and associate chief grasses that the existence of certain grasses should indicate the presence in the site of, or the suitability of the site for, certain tree species and *vice versa*. A very good example is that of *Narenga porphyrocoma* (Syn. *Saccharum narenga*) as an indicator for sal. *Phragmites karka* and *Arundo donax* indicate conditions too wet for all except a few species like *Bischofia*

javanica, Trewia nudiflora, Putranjiva roxburghii, etc. *Erianthus ravennae* would seem to indicate moist mixed forest conditions with *Lannea grandis, Butea frondosa, Gmelina arborea, Cedrela toona, Mallotus philippensis, Terminalia tomentosa, Kydia calycina, Salmalia malabarica* and others as the component tree species (23). Recorded observations do not cover the different forest types.

In a general way, grasses, like other plants, should indicate conditions, processes and uses of sites in which they grow. Bor has grouped the U. P. grasses as indicators of very dry, dry, moderately moist and wet localities (22). Kulkarni has made a similar study of the grasses of the worn out pastures of Bombay, Deccan (24). Similar work on a national scale should form part of the grassland survey of India.

(v) **Indicators of heavy grazing incidence:** The trend of changes in the vegetation follwing heavy grazing has been indicated while discussing the ecological significance of grazing in forests. Species avoided by cattle such as *Butea frondosa, Holarrhena antidysentrica, Casearia tomentosa, Lagerstroemia parviflora, Strychnos nux-vomica, Woodfordia floribunda, Cleistanthus collinus, Mallotus philippensis*, many other species of *Euphorbiaceae, Dodonea viscosa, Adhatoda vasica*, etc. indicate heavy grazing and browsing when they form the chief species of the crop (23). Armed species like *Carissa spinarum, Zizyphus jujuba, Z. oenoplia* etc. often over-run heavily grazed areas. Heavily grazed grasslands have been occupied by *Careya herbacea* in Bengal and by *Xanthium strumarium* in Madhya Pradesh (5). The poisonous grass, *Oryzopsis aquiglumes*, is spreading fast in the temperate regions of Kashmir, because under the prevailing heavy grazing it is the only grass that is allowed to seed. (25, P. 405). Its eradication is one of the grazing problems of Kashmir.

(vi) **Grasslands and their management with reference to biotic factors:** We have seen already that the grasslands in India are generally the result of disturbances caused by man, chiefly, shifting cultivation fire and grazing. Variations in types of grassland produced in a locality are also determined by the way these factors operate in combination with other site factors.

Shiftting cultivation has reduced tree-covered hillsides to grassy slopes in Assam (5) as also in other parts of the country. Climatic condition, the nature of the forest growth cleared and of the surrounding vegetation, the nature and duration of the shifting cultivation, the subsequent exposure of regrowth to fires, grazing etc. are factors which decide the further succssion in abandoned clearings. Even in high rainfall areas where a tree regrowth normally establishes itself after temporary cultivation; prolonged cultivation, absence of conditions favouring coppice or seedling regeneration and pronounced incidence of fires, grazing, lopping, etc. following the cultivation result in the establishment of a grassland. With poor rainfall or a long dry season or effective seeding of grasses in the neighbourhood, shifting cultivation results in relatively easier replacement of tree growth by grass. The type of grassland formed will depend upon the soil-moisture conditions resulting from the cultivation and accessory factors, rank coarse grasses coming up in certain conditions and short, edible grasses in others.

Fire is the chief factor which maintains many tracts of former forest areas in the condition of savannahs and grasslands. The number of tree species which can withstand fire damage is small and even they are killed out by fire in years of severe drought. Under these conditions, perennial grasses are able to establish themselves and often flourish. Though fires may burn the over-ground stems and leaves, they have stimulating effect upon the under-ground parts. Fires also kill out annual weeds and thus give the grasses a good chance. But these perennial grasses are usually very fibrous and are not liked by cattle except when tender. With fires alone or when combined with grazing of wild animals, only this kind of tall grassland is the usual result.

Cattle grazing is generally combind with fires, and this circumstance often modifies the grassland type differently. Firing is resorted to by herdsmen for getting fresh edible shoots of the tall grasses. When big herds of cattle are grazed in the area, the rhizomes are killed out and the grasses assume a depauperate form. Thus burning and a high incidence of grazing produce the short turf grassland [(5), (22)]. That

too heavy an incidence of grazing may leave behind only inedible or poisonous grasses, etc. has already been mentioned.

Closure, which is a common proposal for improving pastures, has the effect in seral grasslands of starting the progression towards the climax. In a woodland climax this would mean ultimately the elimination of grasses and its replacement by a higher form of vegetation. In badly denuded areas, closure up to a limit may help in bringing in useful grasses. Where there are already grasses, closure does not always increase the proportion of palatable grasses as is assumed sometimes. Annual grasses which are soft-stemmed are more edible than perennials. Closure is calculated more to consolidate perennials and eventually to drive out grasses altogether than to increase the annual grasses. In estimating the effect of closure in any area, we should know, therefore, the present seral stage, the tempo of pregression following the closure and the further stages of succession (5).

As in the management of forests so also in the management of grasslands, it is necessary to maintain them in a most valuable stage economically. As with forests, again, this is seldom the climax stage, and a manipulation of these ecological factors which are under the control of man is necessary to stabilize the grasses at a suitable seral stage. Organization of grassland management thus presupposes a comprehensive knowledge of local ecological conditions and the extent to which clearing, cultivation, firing and grazing should be restricted and controlled to produce desired results.

REFERENCE

(1) *Grassland Problems in Western India* - By Burns, W. (1937)

(2) *On Some Important Forest Grasses and their Oecology* - By Hole, R. S., *Indian Forest Memoir, Bot, series* 1, part 1, pp 126. (1911)

(3) *Plant Ecology* - by Weaver J. and Clements, F. E. McGraw-Hill Book Co., New York. pp. 601, (1938)

(4) *The Study of Plant Communities* - by Oosting, H. J. W. H. Freeman and Co., San Francisco. pp. 389. (1948)

(5) Presidential Address to the Botany Section of the Indian Science Congress, Baroda, by Bor, N. L. pp. 145 - 178 (1942)

(6) *A Preliminary Survey of the Forest Types of India and Burma* – by Champion, H. G., *Indian Forest Record*, 1. pp. 280 (1936)

(7) *Manual of General Silviculture for India* - By Champion, H.G. and Griffith, A. L., Oxford University Press, pp. 330 (1948)

(8) *Studies in the Ecology of the Shola-grassland vegetation of the Nilgiri Plateau* - by Ranganathan, C. R. *Indian Forester*, Vol. 64, pp. 523 - 541 (1938)

(9) *The Vegetation of the Nilgiris* - by Bor, N. L. *Indian Forester*. Vol. 64. pp. 600 - 609 (1938)

(10) *The Grass, Fern, and Savannah Lands of Ceylon, their nature and Ecological significance* - by Holmes, C. H. *Imp. For. Inst.* Paper 28. (1951)

(11) *Working Plan for the Coimbatore North Forest Division* - by Ranganathan, C. R. Government Press, Madras.

(12) *Grazing Versus Burning as an aid to Sal Regeneration* -by Rowntree, J. B. *Indian Forester*, Vol. 66, pp. 645 - 653 (1940)

(13) *Grazing and its effect on Simul regeneration* - By Rowntree, J. B *Indian Forester*, Vol. 63, pp. 731-734 (1937)

(14) Annual Progress Report of the Forest Administration in Coorg for the year 1915–16.

(15) *Working Plan for Dalhousie Range Forests of Chamba State (1934 to 1954)* - by Kartar Singh (1934)

(16) *Working Plan for the Siran Forests, Hazara, 1926/27 to 1949/50* -by Gresswell, E. A. (1926/27)

(17) Annual Report on the Forest Reserves in the Punjab, 1927/28.

(18) *Working Plan of Yeotmal Division* (*1938/39 to 1947/48*)

(19) *Working Plan for the Kulu and Seraj Forests* (*1949/50 to 1979-80*) -By Aggarwal K. L. (1949/50).

(20) *Silviculture of Indian Trees* - by Troup, R. S. (3 Vols.) Oxford University Press, pp. 1195. (1921).

(21) *Plant Sociology* - By Braun - Blanquet, J. (Translated, revised and edited by Fuller and Conrad)- McGraw Hill, New York (1932)

(22) *Common Grasses of United Provinces* - by Bor, N. L., *Indian Forest Record, Bot.* 2 (*1*), pp. 222. (1941)

(23) *Problems of Plant Ecology in India* - by Troup, R. S. (contained in Tansley and Chipp's *Aims and Methods in the Study of Vegetation*, pp. 283 - 313) - (1926)

(24) *Grazing Indicators* - by Kulkarni, L. B. (contained (in the Proceedings of the Thirteenth Indian Science Congress, Bombay - (1926)

(25) Proceedings of the Seventh Silvicultural Conference, Dehra Dun, 1946 (1951)

Buffering

CRICKET BAT WITH PATENT HANDLE AND SELECTED ENGLISH WILLOW BLADE

BRANCHES THROUGHOUT INDIA.

Uberoi LIMITED

HEAD OFFICE AT NEW DELHI

Branch :-

Phone No. 706

8/23, AVANASHI ROAD, COIMBATORE.

Elite Thinnings in Madras State

By

T. K. RAJAGOPLAN, B. Sc., M. F. S.

Instructor, Regional Foresters School.

Introduction: What is known as 'Elite thinning' is well known as 'Heck's Free thinning'. As applied to teak crops in Madhya Pradesh, Shri Sagreiya has called it the 'Single Stem Silviculture'.

Elite thinning was introduced as a regular method in 1955 by Shri S. K. Bassu, I. F. S., the then Chief Conservator of Forests, Madras, for the teak plantations of the State. Prior to this the method was tried on a small scale in Wynaad and Madura Divisions. An attempt was also made to introduce this method in the Coimbatore south Division in 1947-48.

Necessity for changing the old thinning practice (Ordinary thinning method): At the outset it should be realised that the change was brought about not because of any defect in the old method of ordinary thinning, but because of the difficulties experienced in executing the thinnings to uniform standard conforming to the objects of management. The following deserve consideration with regard to the difficulties experienced in the past.

1. In the pre-reorganised State of Madras, large areas were under teak plantations mainly in the divisions of Nilambur, Wynaad and Coimbatore South. One Gazetted Assistant was in-charge mainly of thinning operations in each of these divisions. During the war years thinnings had fallen very much into arrears. With these arrears and the progressively increasing areas under teak, it was found difficult to complete the thinning operations to schedule. The importance of executing thinnings to schedule needs no emphasis.

2. Though there are accepted 'rules of thumb', yield table data and the like to guide the thinning officer in executing thinnings to a particular grade, yet in actual practice, consdering the individual growth, position (near roadside, nullahs, etc.,) etc., certain amount of deviation from such rules is essential. It would be unwise to apply the

guiding rule rigidly under such circumstances. On such occasions, the personal bias of individuals comes into play and influences the quality of the work. Such personal factors affect the uniformity of the stand with regard to the number of stems per acre and the proper spacing out of the stems. In other words, one of the basic principles of management, viz., the maximum utilistation of the site, often suffers.

These difficulties call for a more simplified thinning technique and it is believed that Elite thinning would be the nearest approach to that aim.

Method of executing the elite thinnings:

1. All teak plantations of and below 20 years of age will be included under this technique. Older plantations will continue to be treated under the old method of selective ordinary thinning.

2. Elites will be marked at the first thinning. For plantations which have had one thinning, elites will be marked forthwith.

3. The number of elites to be marked per acre is the yield table number of final crop stems at rotation age corresponding to the average site quality of the plantation. The elites should as far as possible be evenly spaced. To achieve this the following procedure is prescribed:—

(a) Divide each acre of plantation into as many equidimensioned quadrats as there are elites decided upon per acre for that quality.

(b) Select one good stem in each quadrat, as far as possible, in the centre. If it is not possible, there is no harm in selecting one though eccentrically placed inside the quadrat, provided it is within the limits of espacement prescribed for the elites.

(c) If no good stem is available inside the quadrat, select the best amongst the available lot. Such elites would be 'countesy elites'.

(d) In no case should the espacement limits prescribed for that quality between elites be exceeded. Usually, a difference of 5′ to 8′ between the maximum and minimum espacement, depending on the quality, is adopted.

4. The elites should be marked either by a ring of white paint at B, H. or by nailing a numbered metallic *tally* on the bole. It is indicated that even if the paint fades away or the tally falls off in due course, it could not be difficult to identify the elites from a group of stems in view of the special treatment given to them.

5. All thinnings will be done for the benefit of the elites only. The rest of the stand will be allowed to fend for themselves.

6. The old thinning intensity (i. e., the thinning grade and the thinning cycle) as followed for the ordinary thinning method will continue. (Note :— some are under the misapprehension that the thinning grade under the elite thinning would be much heavier than any standard grade of ordinary thinning. In fact, no deviation from the old practice as indicated regarding the radius to which thinnings should be carried out around the elites).

7. In case any of the elites gets eliminated due to death, wind damage, etc., selection of a suitable 'substitute from amongst the rest of the standing crop is indicated. It is hoped that such accidents to the elites would be rare and negligible.

8. Seletion of the elites should be done by a Gazetted Officer.

Advantages claimed for the Elite method:—

1. Except for the first marking of the elites, the time taken for the thinning operations is very much less when compared with the ordinary thinning method. Thus the services of the Gazetted Officer can better be utilised for other operations.

2. There is no risk of thinnings getting postponed.

3. The maximum final yield is assured.

4. There is less chance for the play of personal bias in as much as the thinning officer has to concentrate only on elites and thin around for their benefit. There is no need to make a comparative study of the merits and demerits of stems in a group. It is reasonably possible to entrust the work of thinnings to an official of lower rank than a Ranger provided the thinning grade is indicated in a measurable quantity,

5. The espacement of final stand will be more or less uniform thereby providing every tree composing the final crop equal growing space and light. Evil effects due to exposure of soil on account of uneven spacing of the final stand are avoided.

6. Maximum value yield from larger sized timbers would be possible.

7. It is indicated that the exploitable girth could be achieved in a shorter time than under the ordinary method. So, the crop could be worked on a shorter rotation.

8. Though the thinnings are done to the best advantage of the elites only, it is irrefutable that the peripheral stems retained around the elites after the thinning do get 1/2 to 3/4 crown space for their growth. These may, to certain extent, contribute, to the intermediate yield of good sized pole crop when they are removed.

Disadvantages attributed by critics:—

1. It would be risky to switch over to a new technique without concrete experimental data as to the advantages and the ultimate reactions.

2. It would be too early to study the individual characteristics of a tree at the time of first thinnings, i. e., in the 4th year. It would be better to select the elites after the crown differentiation sets in. (usually when the tree is about 40′ to 50′ in height). The difference in growth due to local soil variations will also not be pronounced at that age.

3. A great fall in the intermediate yield is reasonably expected. Normally, under the ordinary thinning method, nearly about 40 to 50 percent of the final yield is obtained as intermediate yield. How far the anticipated increase in the final yield under this technique would compare with the loss in the intermediate yield is a matter for serious study.

4. If, as indicated in the advantages of the method, it is possible to increase the rate of growth of the elites, how far such an increase in rate of growth would affect the various qualities of the timber is again a matter for serious study. Mr. Laurie has indicated 6 to 15 rings per inch of radius as the optimum growth rate for good quality timber An attempt to bring down the number of rings to 4 per inch of radius might affect the quality of timber in some respects. In this connection it would be interesting to note that Mr. Hiley in his book on 'WOODLANDS MANAGEMENT' writes that for ring-porous hardwoods, the density of the wood increases with the fastness of growth, i. e. with the reduction in the number of rings per inch of radius from the normal. Density is not the only quality to be considered for a good timber. The effect of fast growth on the working quality, durability, etc., should be studied.

5. In the past, poles obtained from thinnings, to a great extent solved the needs of the public for small construction purposes and of the Government for electric transmission poles. During the plan periods, when a great expansion of electrification schemes is planned, the great need for teak poles should not be overlooked or lost sight of. At this juncture, the introduction of elite thinnings in a way that is calculated to reduce the intermediate yields might affect these national schemes.

Conclusion:- On a careful examination of the advantages and disadvantages attributed to the 'Elite' thinning method, one is bound to feel that a more careful and unbiased study on the following aspects might be beneficial.

I. *The age of the teak crop at which the marking of the elites should be taken up*: Some are of the opinion that the elite marking should be done when the crown differentiation has set in, in order to distinguish the individual characters. The opposite school is of the opinion that any tree if tended with special care from early youth by providing it with optimum growing space and light is bound to respond well irrespective of other influences. Further, they feel that by marking the elites on a later date might make them loose the advantage of special attention in early stage.

To what extent the method meets the demands of the public and the Government from intermediate yields and how best the technique could be modified or improved to supply better quality intermediate yields :- In fact one of the main criticisms of the new method is that there would be great fall in the valuable intermediate yields of good sized poles, The opposite view is that there would not be as much fall of intermediate yield as the critics of the method visualize. Those stems that are retained in early years around the elites do get 1/2 and 3/4 crown spaces for their growth and they would yield to some extent poles needed by the public and Government.

In fact it is learnt that the Chief Conservator of Madras has prescribed the first thinning as 'Elite-cum-mechanical' thinning, for the Hullikal Irrigated Teak plantations.

Whether a second mechanical thinning and a third selective thinning (if necessary) to the rest of the stand to yield better poles would be advisable is a matter worth serious consideration.

3. *Whether it would be possible to reduce the rotation.*

4. *Once the elites are marked, whether it would be sound to entrust the execution of thinning operations to a forester or a forest guard is also worth a study.*

5. *People's reaction to the quality of a fast grown timber.*

People are sensitive in making a distinction between natural teak and plantation teak. So, how far teak which is made to grow excessively fast would react on the consumers should also be considered.

Geography in The Economic Planning of India

By D. S. RAGHUVANSHI, M. A., (Lucknow).

(1956—58 Course).

"Geography is the knowledge of Earth and dwellings of man upon it" — *Thomas Arnold.*

Geography never changes with the change in an Empire, or the creation of more dominions. India has washed off the centuries old alien rule from her soil; she is free to-day and faces new problems of economic planning and reconstruction. This is a big task and can only be properly entered into by the co-ordination of various fields of knowledge.

Geography can go a long way with planning, and how it can be of help, will be of interest to us here. Geography is essentially one of the field sciences, which takes into account the individual findings of other sciences, geology, meteorology, hydrology, agriculture, etc., and synthesises them into a geographical perspective. Other field sciences investigate various terrestrial phenomena individually. Geographers, who keep in touch with the findings of other sciences, make a synthetic study of them from a solely rationalistic and humanistic view-point. All the geologic and climatic environments of the land are critically studied from the point of Man and his Society. An emphasis is laid on the study of natural resources, and how far they can be exploited and conserved for developing the economic resources.

As geographer has before him a clear picture of the country's present and potential resources in conjunction with the present pattern of population, he is in a better position to indicate a line of the country's economic development with a view to creating an economy in different natural regions of the land. His aim is to create a state of 'Geographic Equilibrium' between the present natural resources and population pattern.

We stand to-day in a land which has been exploited and impoverished by two centuries of alien rule. Moreover, we stand in the scientific age where scientific technique and industrial development

have been synonymous with the economic progress of the country, and as such study of Industrial Geography has assumed tremendous importance in the planning of the country. Here the Indian geographer is called to point out the country's terrestrial resources, the reserve of basic raw materials of industry, and the total reserve of solid and liquid fuels in different quantities and their geographic distribution in the light of present scientific investigations. It is for the geographer to make a thorough survey of mineral resources in which India is specially rich, so that proper exploitation can be done, as well as proper assessment of the minerals in which India is extremely poor. Not only this, but the Industrial Geographer will have to point out the proper location of India's future industries based on the exploitation of her raw materials with reference to the availability of cheap power, adequate transport facilities, supply of skilled labour and accessibility to the comsuming markets. Its aim will be to meet the maximum demand at the least possible loss to the natural resources and to labour. On the Statistical figures of basic raw materials, viz., hematite, manganese, chromite, mica, etc., India is specially rich in most of these, and is said to have a bright future in all types of Iron and Steel Industries, Aluminium Industry, Chemical and Electro-chemical and also various auxiliary industries in paper, fertilizers and dye-stuff industries. India has a promising future, considering her forest and grass land resources, abundant water supply and sufficient chemical salts. Agricultural industry including harvesting, milling and packing of India's surplus food-stuffs has immense scope of development. In all cases it will be the task of the nation's Geographers to assess the country's natural resources, their utilization in the industrial as well as scientific development, but with a view to judicious conservation for the future.

Development of 'power-resources' in India is the *sine qua non* of her Industrial progress. The prime objective of industrial Geographers would be the planning for the generation of millions of kilo -watt hours of energy from so-called inferior or waste coal, scattered all over India. A detailed topographic and hydrographic survey from geographer's pen will point out numerous streams which have been so long neglected as useless, and can be a potential source of water-power. We should aim at covering the whole of India with a net-work of electric grids

from every hydro-electric plant and coal mines. producing power at the cheapest possible cost. Reorganisation of coal industries will include among other things, the recovery of multitudes of bye-products from sheer waste, and the setting up of a number of subsidiary industries adjacent to the mining areas. A geographer's approach would be to a regionalization of industries, but with due regard to the pattern of population and the avoidance of congestion. His aim will be to put a 'regional equilibrium' over the entire land with an even burden of population and Socio-Economic harmony.

For a so-called agricultural country like ours, where 70% of the people depend on the soil for their subsistance and 80% live in villages, geographic studies are of immense help if not of fundamental importance. The study of Agricultural Geography constitutes the fundamental of our economic life. A geographical survey of India's agriculture will bring to the light the extent of land under different types of land usage, the nature of her agricultural resources in the shape of her production and the strength of her live-stock population. Out of the total 1562 million acres of land in Hindustan only 275 million acres are sown, 88 millions are cultivable waste land and 54 millions are fallow land. The statistical figures at the time of a normal harvest indicate a shortage of food for millions of people. Add to this the frequent occurrence of famine and starvation in the country which is predominantly fertile. This reflects on the lack of geographic knowledge. Living amidst a fickle nature and with a poor knowledge of of the world around, the Indian farmer's rich lands yield poor harvests. The abnormally low yield of most of the Indian crops is due to the absence of proper manuring, crop rotation and lack of any soil conserving practices and also to the heavy burden of population, both of men and cattle.

A scheme of land utilization survey under the aegis of the state conducted by the expert geographers, for knowledge of the precise areas that can be brought under the plough in addition to the existing ones will point out the areas where food crops should be raised in place of commercial ones.

With the problems of Indian agriculture is associated the disease of soil erosion which is going to be a great menace in agriculture. A

colossal survey in this field by the geographers, conversant with the details of topograhy, climatoflora and environment of the land will indicate the fact that more than 150 million acres have been ruined beyond practical agriculture, under the continued attack of various forms of soil erosion. It will indicate that vast areas are losing their productivity and gradually merging into marginal lands. Such a creeping death under particular climate and physiographic environment calls for a number of practical steps, controlling the menace of soil erosion and in the reconstruction of India's agriculture. Practical steps have been suggested through a little work done in this direction. They include afforestation, field terracing and contour ploughing in the hilly tracks of the Siwaliks, Chotta-Nagpur plateau and central India forest lands. The utility from the 'climato-isopletheic' studies in the United States of America and 'agro-climatology' in Soviet Russia, have proved to be of immense help in the geographic control of crop production programme of agricultural reconstruction.

India is an extensive country, and any plan for future development will fail without a development of means of transport and communications. Roughly 350 millions of her people live in 600,000 villages which are mostly cut off from the outside world, because of undèveloped means of communication. In a total of 1,221,072 square miles of land, the railway mileage comes to only about 60,000 whereas roads extend to 500,000 miles (only about 100,000 miles are metalled). So under-developed are the present highways in our country that we know little of the many villages and vast fields still remaining unexploited with elaborate means of geographic study of topography and settlement patterns of the country. Geographers can aptly advise in the task of constructing a net work of railways and high ways linking every village, town and port. A good means of communication would make a market accessible to every corner of our country, and every bit of our land accessible to the enterprizing tillers. A speedy means of transport will create mobility of labour among the idle labourers and would then reduce the burden of population from agricultural fields.

The tool of the Geographer is his map. For any kind of reconstruction whether industrial or agricultural, or for the development of

communications, the use of maps representing the basic data is indispensable. It is for geographers, and no one else, to prepare under the aegis of the state a set of 'basic maps' for an economic planning of India. These maps will indicate India's mineral and power resources, the usage of land and soil resources, the pattern of population and the type of settlements. These will guide in the planning of industrial and agricultural reconstruction, and in fact every phase of our national life.

We hear from press reports that the U. S. A., Russia, and other western countries have gone ahead in their economic planning with the help of state geographers. Why should we lag behind? This branch of knowledge is slowly comming in the field and getting recognition in many of the state universities. The contribution of Geography must be immense in the future planning of our mother land.

FOR

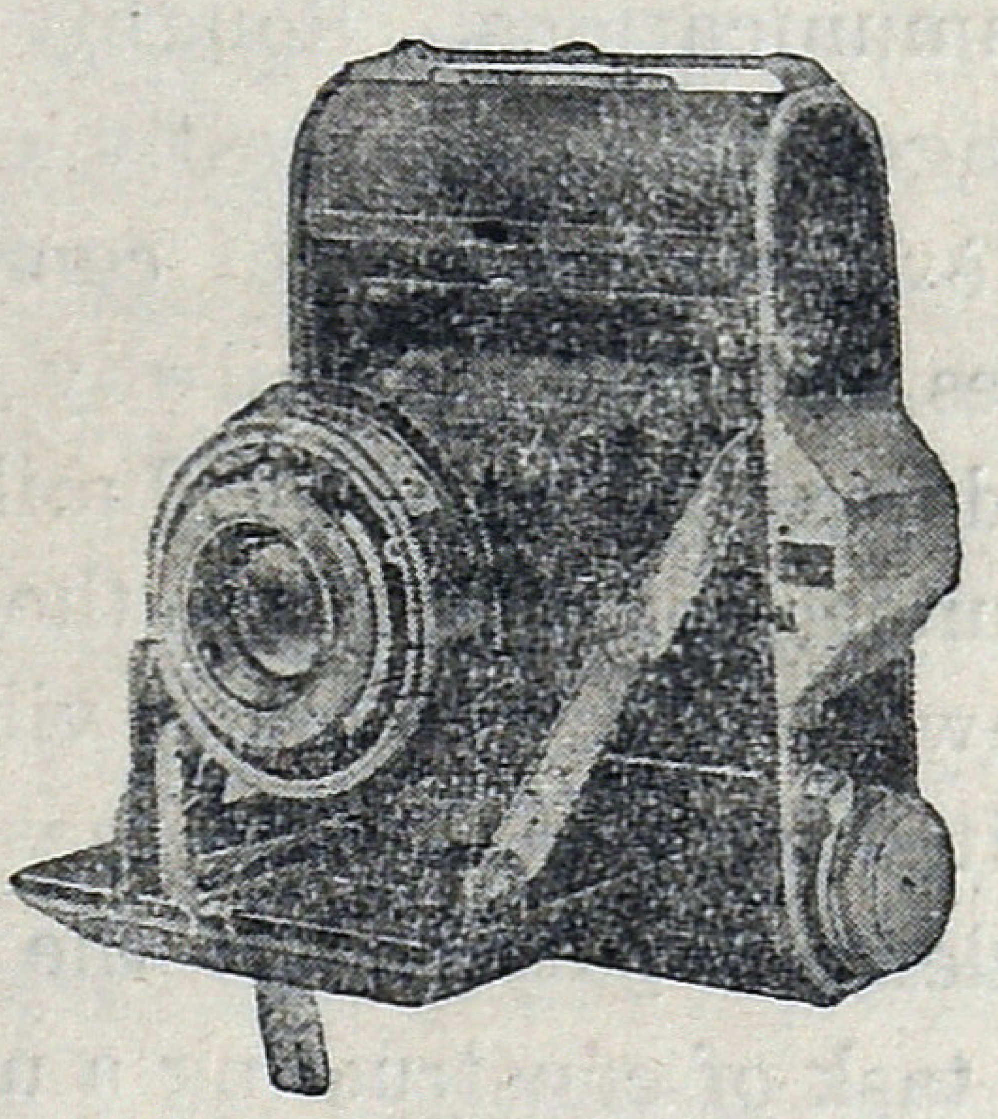
CAMERAS, ACCESSORIES OR FILMS

OR

LIFELIKE PORTRAITS

&

GROUP PHOTOGRAPHS



Always remember your favourite Shop

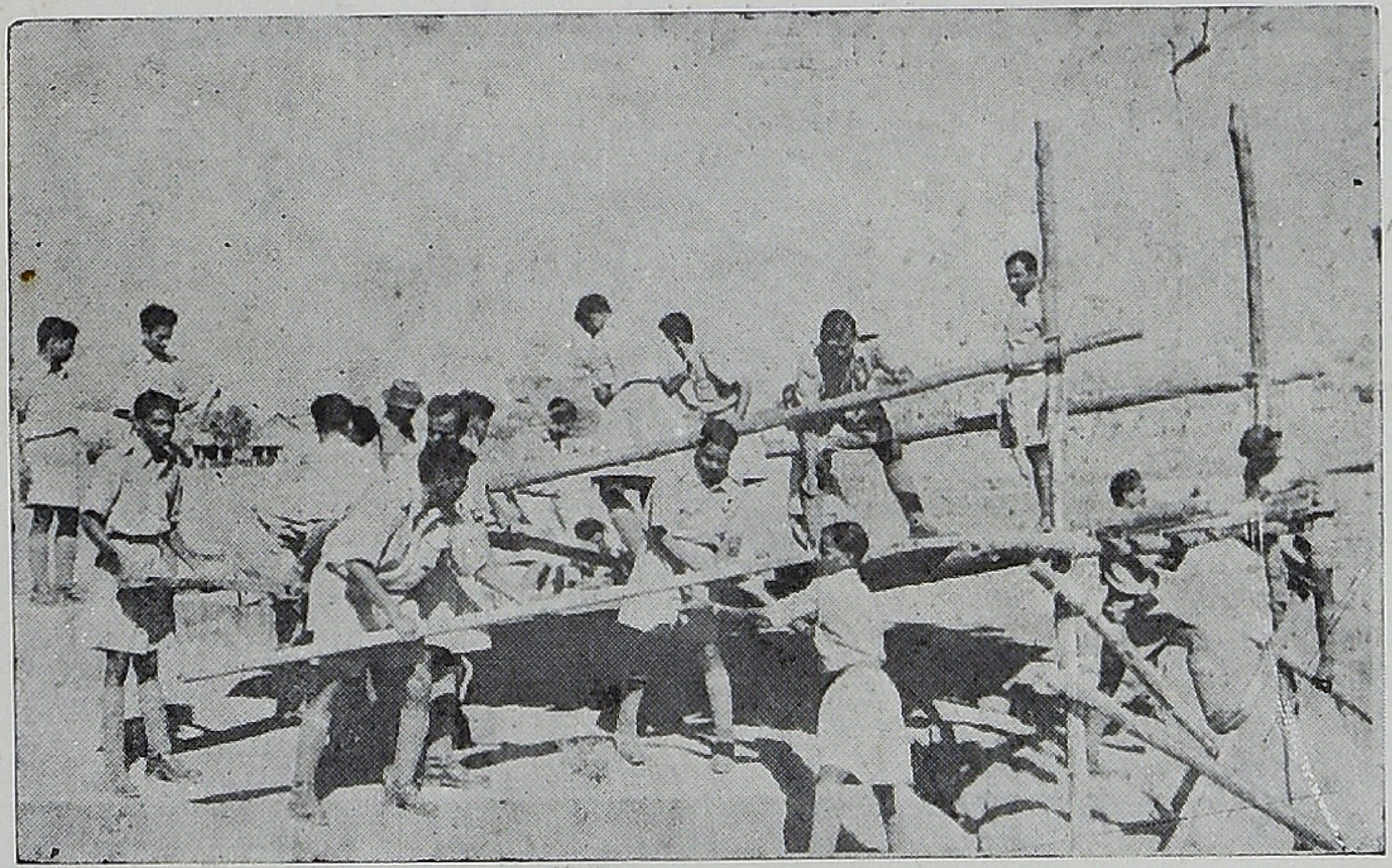
CITY CAMERA HOUSE

VARIETY HALL ROAD

COIMBATORE

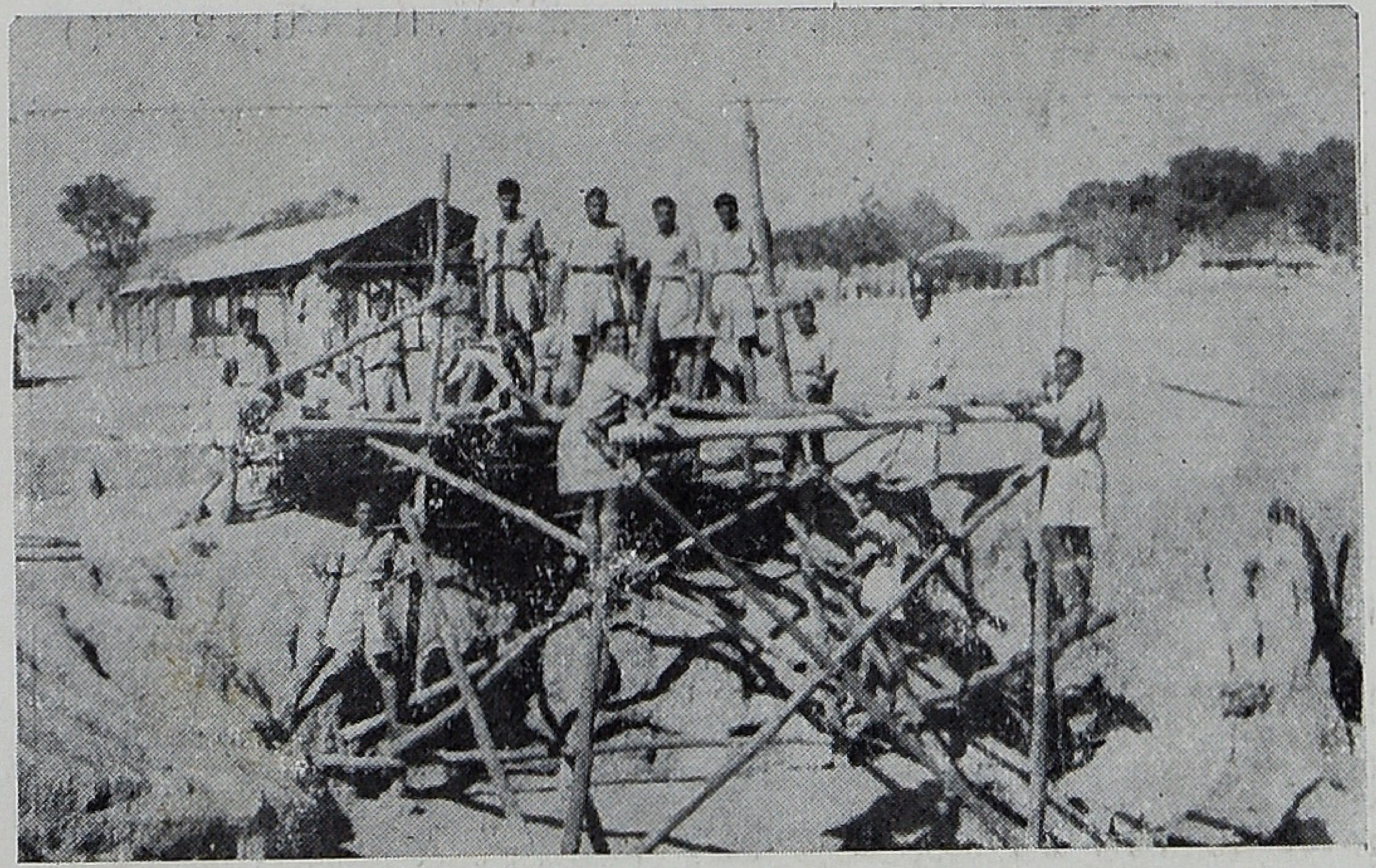
Amateure Service Our Spciality.

Phone: 941.

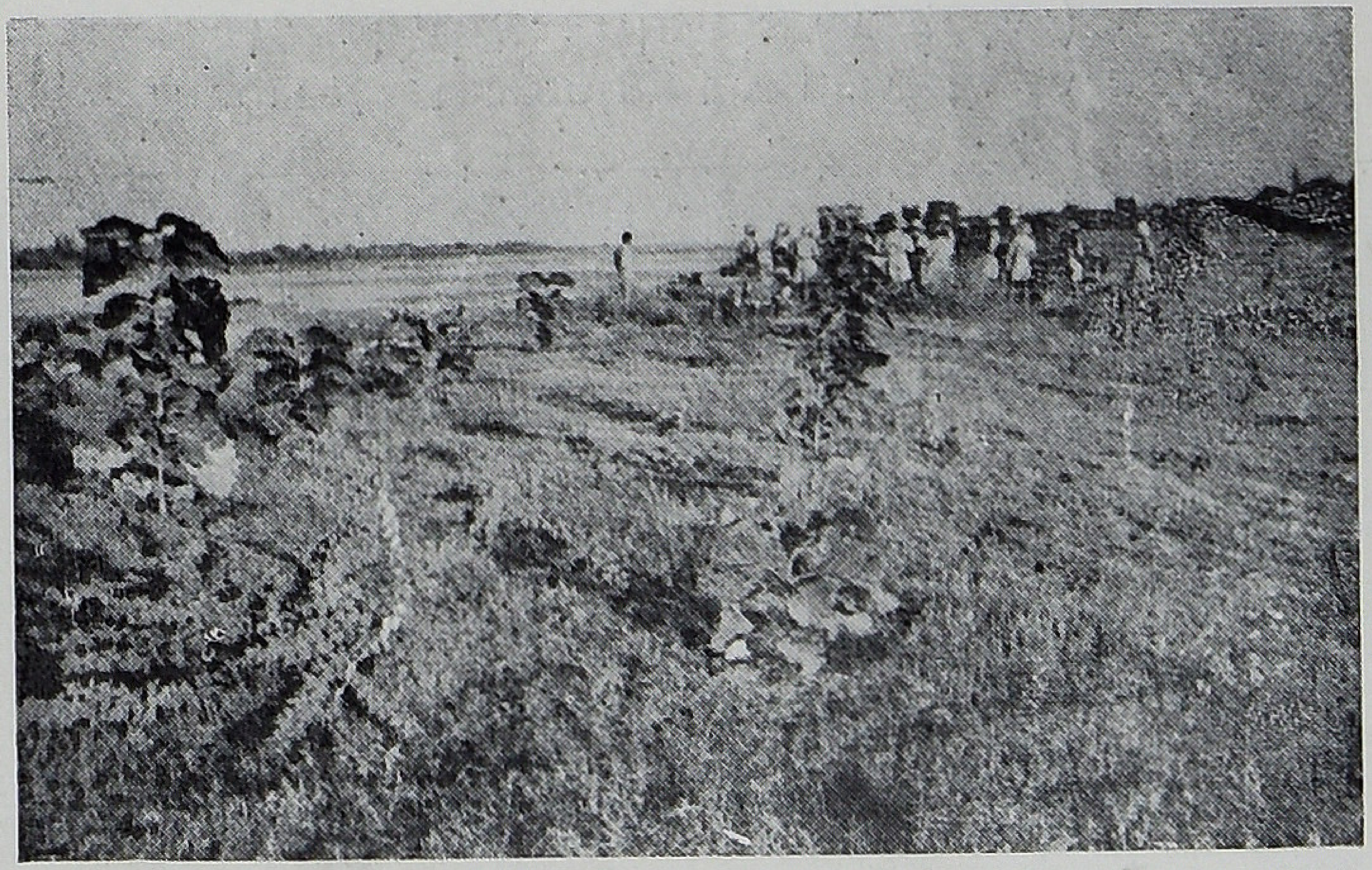


R. F. S. students constructing Trestle bridge at Bangalore (3—2—'58)

R. F. S. students weeding the 1957 Casuarina R. A. Mayanoor. (12—2—'58)
—Note the thick growth of *Prosopis*.

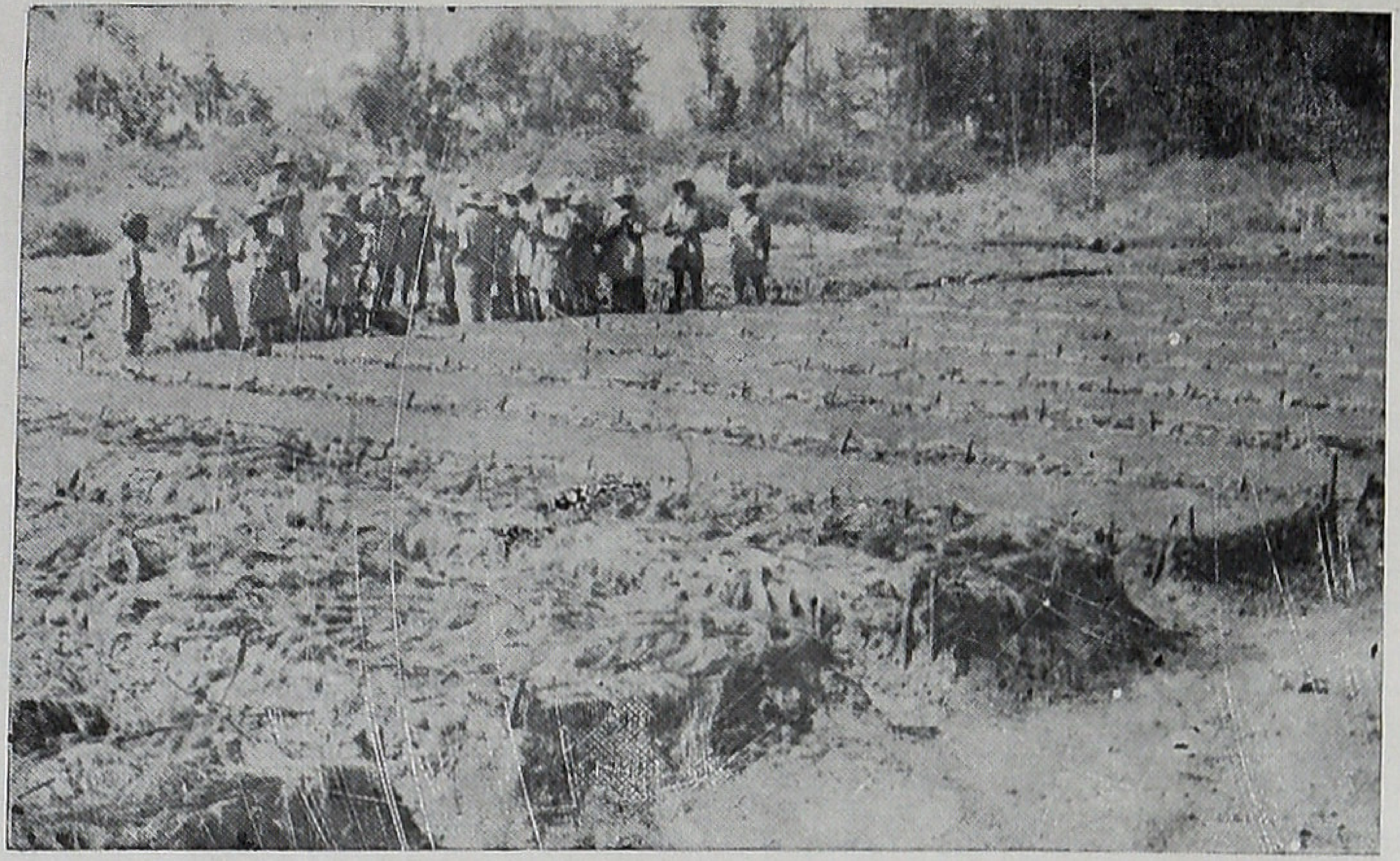


R. F. S. students dismantling the Trestle bridge at Bangalore (3—2—'58)

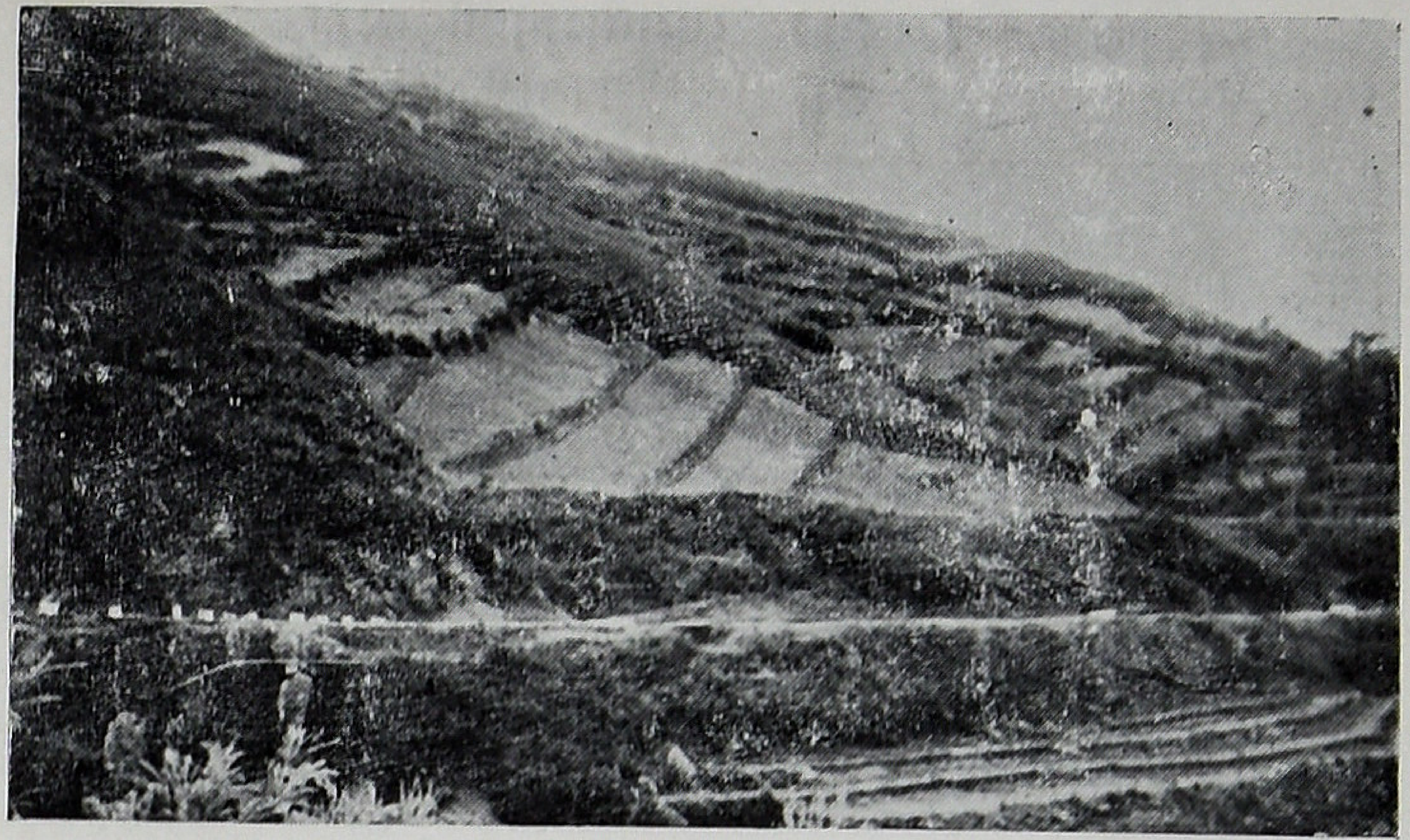


1957 Teak plantation on the Cauvery bank. Tiruppalathurai. (12—2—'58)

—*Photos by T. R. Somasundaram.*



Casuarina nursery, Lalapet, Tiruchi Division (12—2—'58)



Incorrect terracing by private owners, Kaity, Nilgiris (May '56)

Students thinning in Wattle plantation, Lovedele, Nilgiris (May '56)

Terracing as done by Soil Conservation Division, Ooty at Kaity (May '56)

—*Photos by T. R. Somasundaram.*

An Artificial key to the Identification of some important families of South Indian Flowering (Phanerogamic) Plants

By T. R. SOMASUNDARAM, B. Sc.,
Curator, Gass Forest Museum, Coimbatore

(Note:— This artificial key is compiled for the author's hand-book for the identification of the more important species of the forests of South India, for the benefit of the students of the Southern Forest Rangers College, under compilation.

The author is indebted to Dr. K. Subramanyam, Regional Botanist, Botanical Survey of India, Coimbatore for going through the key and making valuable suggestions.)

Ovules enclosed in ovary wall ... **ANGIOSPERMS** (A)

Ovules not enclosed in ovary wall ... **GYMNOSPERMS** (B)

A. ANGIOSPERMS

Cotyledons 2; tap-root system; leaves net veined ... **Dicotyledons** (I)

Cotyledon 1; adventitious root-system; leaves parallel venied* ... **Monocotyledons** (II)

(Exception: *leaves net-veined in *Smilax* of Liliaceae)

I. Dicotyledons

1 Sepals and petals present* ... 2

(Exception: *petals absent in some *Ranunculaceae, Bixaceae, Sterculiaceae, Rutaceae, Celastraceae, Rhamnaceae, Combretaceae, Myrtaceae* and *Samydaceae*)

Petals absent or if present sepals and petals not distinguished (perianth) ... APETALAE (c)

2 Petals free* ... POLYPETALAE (a)

(Exception: *Petals more or less fused in some *Tamaricaceae, Ternstroemiaceae, Olacaceae, Ilicaceae, Vitaceae, Mimosoideae,* and *Cucurbitaceae*)

Petals united* ... GAMOPETALAE (b)

(Exception: *Petals free in some *Myrsinaceae* and *Symplocaceae*)

a. POLYPETALAE

1 Sepals free* hypogynous ... 2

(**Exception:** *Sepals variously united in *Dipterocarpaceae, Malvaceae, Sterculiaceae, Burseraceae, Meliaceae. Sapindaceae*, some *Rutaceae*, and *Ilicaceae*)

Sepals connate, not hypogynous; stamens inserted on calyx-tube (*Calyciflorae*) ... 42

2 Thalamus small or elongated, not expanded (*Thalamiflorae*) ... 3

Thalamus thickened or expanded into fleshy disc *(*Disciflorae*) ... 23

(**Exception:** *Disc absent in *Ilicaceae* and *Coriareae*, obscure in *Linaceae* and *Malpighiaceae*)

3 Carpels free ... 4

Carpels united ... 9

4 Stamens indefinite ... 5

Stamens definite (not more than 10) ... 8

5 Herbs or soft-wooded climbing shrubs ... *Ranunculaceae*

Trees or woody shrubs, rarely climbing* ... 6

(**Exception:** **Schizandra* of Magnoliaceae)

6 Sepals and petals 5-merous ... *Dilleniaceae*

Sepals and petals 3-merous ... 7

7 Stipules present*; endosperm even ... *Magnoliaceae*

(**Exception:*** Stipules absent in *Schizandra*)

Stipules absent; endosperm ruminate ... *Annonaceae*

8 Flowers minute; seeds curved ... *Menispermaceae*

Flowers large seeds not curved ... *Berberidaceae*

9 Placentation parietal ... 10

Placentation not parietal ... 12

10 Stamens tetradynamous ... *Cruciferae*

Stamens not tetradynamous ... 11

11 Ovary stalked seeds exalbuminous ... *Capparidaceae*

Ovary sessile; seeds albuminous ... *Bixaceae*

12	Placentation axile	... 13
	Placentation free-central; leaves minute (scale-like); seeds hairy	... *Tamaricaceae*
13	Stamens definite (as many as or twice as many as petals)	... 14
	Stamens indefinite	... 15
14	Stamens 5	... *Pittosporaceae*
	Stamens 8	... *Polygalaceae*
15	Sepals imbricate in bud, or valvate and irregular	... 16
	Sepals valvate in bud, regular	... 19
16	Sepals imbricate in bud	... 17
	Sepals valvate in bud, irregular, adnate to ovary, accrescent	... *Dipterocarpaceae*
17	Leaves opposite, gland-dotted; stamens 1-6 adelphous	... 18
	Leaves alternate, not gland-dotted	... *Tenstroemiaceae*
18	Petals twisted	... *Hypericaceae*
	Petals imbricate or absent	... *Guttiferae*
19	Stamens monadelphous	... 20
	Stamens polyadelphous or free	... 22
20	Anthers 1-celled	... 21
	Anthers 2-celled	*Sterculiaceae*
21	Leaves simple	... *Malvaceae*
	Leaves digitate	... *Bombacaceae*
22	Bark mucilaginous, fibrous	... *Tiliaceae*
	Bark not as above	... *Elaeocarpaceae*
23	Stamens more than petals	... 24
	Stamens equal or fewer to petals	... 32
24	Stamens twice the number of petals; filaments often united; placentation axile; style 1-5	... 25
	Stamens 8 or less; flowers bisexual or polygamous, often irregular;	38
25	Leaves simple	... 26
	Leaves compound	... 28

26	Leaves alternate; flowers regular; fruit not winged	... 27
	Leaves opposite; flowers not regular; fruit winged	... *Malpighiaceae*
27	Leaves stipulate; plants with wateryj udice;	*Ochnaceae*
	Leaves exstipulate; plants without watery juice	... *Linaceae*
28	Leaves gland-dotted	... *Rutaceae*
	Leaves not gland-dotted	... 29
29	Leaves opposite	... *Zygophyllaceae*
	Leaves alternate	... 30
30	Stamens monadelphous	... *Meliaceae*
	Stamens not monadelphous	... 31
31	Flowers unisexual	... *Simaroubaceae*
	Flowers bisexual or polygamous	... *Burseraceae*
32	Seeds winged; ovary 1-celled	... *Moringaceae*
	Seeds not winged; ovary more than 1-celled	.. 33
33	Filaments free at base; disc prominent; ovary immersed in disc	... 34
	Filaments more or less connate at base; disc absent	... 36
34	Sepals imbricate; stamens alternating with petals	... *Celastraceae*
	Sepals valvate; stamens opposite to petals	... 35
35	Erect plants; stem joints not swollen	.. *Rhamnaceae*
	Climbing plants; stem joints swollen	... *Vitaceace*
36	Flowers bisexual	... 37
	Flowers unisexual	... *Iliciaceae*
37	Placentation free-central	... *Olacaceae*
	Placentation apical	... *Icacinaceae*
38	Flowers regular	... 39
	Flowers not regular	... 41
39	Plants resinous; stamens as many as and opposite to petals, often few are fertile; ovary 1-celled	... *Anacardiaceae*
	Plants not resinous	... 40

40	Stamens 5, opposite to corolla-lobes ...	*Sabiaceae*
	Stamens 5, alternating with corolla-lobes ...	*Staphyleaceae*
41	Ovary 2-celled, compressed; filaments not hairy ...	*Aceraceae*
	Ovary 2-3-celled, not compressed; filaments hairy ..	*Sapindaceae*
42	Plants fleshy; stems jointed bearing spines; leaves reduced or absent ...	*Cactaceae*
	Plants not fleshy; stems not jointed ...	43
43	Carpels 1 or more, free (or variously united)	44
	Carpels more than 1, united ...	47
44	Leaves compound ...	45
	Leaves simple; exstipulate ...	*Saxifragaceae*
45	Leaves exstipulate; flowers in panicles ...	*Connaraceae*
	Leaves stipulate ...	46
46	Carpel 1; fruit a legume; calyx with a median anterior lobe ...	*Leguminosae*
	Carpels more than 1, free*; fruit not a legume; calyx with a median posterior lobe ...	*Rosaceae*
	(Exception: *Carpels united in genus *Pyrus*)	
47	Ovary inferior ...	48
	Ovary superior or half inferior ...	61
48	Placentation parietal; flowers unisexual ...	58
	Placentation not parietal ...	49
49	Ovules more than 1 in each carpel ...	50
	Ovules 1 in each carpel, pendulous; stamens definite ...	55
50	Connective of anthers with appendages ...	*Melastomaceae*
	Connective of anthers without appendages	51
51	Leaves gland-dotted, aromatic, opposite...	*Myrtaceae*
	Leaves not gland-dotted	52
52	Leaves alternate; ovary many-celled ...	*Lecythidaceae*
	Leaves opposite ...	53

53 Ovary many-celled ... 54
Ovary 1-celled; ovules pendulous; fruit angled or winged ... *Combretaceae*

54 Flowers in corymbs of 3-5 ... *Sonneratiaceae*
Flowers solitary or in panicles ... *Punicaceae*

55 Fruit drupaceous ... 56
Fruit not drupaceous ... 57

56 Leaves stipulate ... *Araliaceae*
Leaves exstipulate ... *Cornaceae*

57 Fruit a berry, crowned by calyx and disc ... *Alangiaceae*
Fruit of 2 indehiscent mericarps, separated by a commissure; pericarp traversed by oil canals ... *Umbelliferae*

58 Leaves stipulate ... 59
Leaves exstipulate ... 60

59 Prostrate or tendril climbers; stamens 5 or less; ovary not winged ... *Cucurbitaceae*
Succulent herbs; stamens indefinite; ovary often winged ... *Begoniaceae*

60 Soft-wooded branchless trees with milky juice; leaf-scars present on stem; dioecious; fruit 1-celled ... *Caricaceae*
Trees or shrubs without leaf-scars on stem; fruit 3-8 celled ... *Datiscaceae*

61 Placentation parietal ... 63
Placentation not parietal (axile) ... 62

62 Leaves stipulate ; viviparous ... *Rhizophoraceae*
Leaves exstipulate ; non-viviparous ... *Lythraceae*

63 Leaves gland-dotted ... *Samydaceae*
Leaves not gland-dotted ... 64

64 Tendril climbers; leaves without glands at base ... *Passifloraceae*
Undershrubs; leaves with 2 glands at base ... *Turneraceae*

b. GAMOPETALAE

1	Ovary inferior or adnate to calyx; stamens equal to corolla-lobes (*Inferae*) ...	3
	Ovary superior ...	2
2	Carpels more than 2; stamens as many as corolla-lobes or more (*Heteromerae*) ...	9
	Carpels 2; stamens as many as corolla-lobes or fewer (*Bicarpellatae*) ...	14
3	Flowers regular or not; stamens epipetalous ...	4
	Flowers usually irregular; stamens not epipetalous ...	8
4	Ovary 1-celled, sometimes more than 1-celled when only 1-ovuled ...	6
	Ovary more than 1-celled; ovules 1-many in each cell ...	5
5	Leaves exstipulate ...	*Caprifoliaceae*
	Leaves with inter-petiolar stipules ...	*Rubiaceae*
6	Flowers in capitula; ovary 1-celled and 1-ovuled. ...	7
	Flowers not in capitula; ovary 3-celled, but only one is 1-ovuled ...	*Valerianaceae*
7	Anthers syngenesious; stamens 5 ...	*Compositae*
	Anthers not syngenesious; stamens 4 ...	*Dipsacaceae*
8	Ovary 5 or 10 celled ...	*Vacciniaceae*
	Ovary 2-5 celled ...	*Campanulaceae*
9	Plants with milky or watery sap ...	10
	Plants without milky or watery sap ...	11
10	Trees with milky sap; ovary 2-8 celled; ovule 1 in each cell ...	*Sapotaceae*
	Trees or shrubs with watery sap; ovary 2-4 (usually 3) celled; ovules 2-4 in each cell ...	*Symplocaceae*

11	Flowers unisexual ...	*Ebenaceae*
	Flowers bisexual ...	12
12	Stamens inserted on thalamus; anthers opening by apical pores ...	*Ericaceae*
	Stamens inserted on corolla; anthers with no apical pores ...	13
13	Leaves gland-dotted; calyx with glands; style 5-fid; ovule 1 ...	*Plumbaginaceae*
	Leaves not gland-dotted; calyx with no glands; style undivided; ovules 2-many ...	*Myrsinaceae*
14	Corolla regular; stamens not didynamous	15
	Corolla irregular; stamens didynamous or 2 ...	21
15	Leaves opposite * ...	16
	Leaves alternate ...	19
16	Stamens 2 ...	*Oleaceae*
	Stamens more than 2 ...	17
17	Juice often milky; stamens 5 ...	18
	Juice not milky; stamens 4-5; stipules present or represnted by a raised line joining the bases of petioles ...	*Loganiaceae*
18	Filaments monadelphous; anthers adnate to stigma; carpels free ...	*Asclepiadaceae*
	Filaments free; anthers not adnate to stigma; carpels generally fused ...	*Apocynaceae*
19	Ovary cells many-ovuled; corolla-lobes plicate; style 1 ...	*Solanaceae*
	Ovary cells 2- (seldom 1-, rarely 4)ovuled...	20
20	Juice (often) milky; prostrate or climbing plants; fruit often dehiscent ...	*Convolvulaceae*
	Juice not milky; hispid herbs, shrubs or trees; fruit generally of indehiscent nutlets	*Boraginaceae*

21	Ovary 1-2 or rarely 4-celled; ovules many; corolla often 2-lipped (personate) ...	22
	Ovary 2–4 celled; ovule solitary in each cell or rarely more ...	26
22	Leafless parasites on roots ...	*Orobanchaceae*
	Leafy non-parasites, ovary 2-celled ...	23
23	Bracts conspicuous ; stem with swollen nodes ; fruit opening by jaculators ...	*Acanthaceae*
	Bracts minute or absent; stem without swollen nodes; fruit without jaculators ...	24
24	Leaves compound; seeds winged* ...	*Bignoniaceae*
	Leaves simple; seeds not winged ...	25
25	Ovules many on placentas attached to the middle of septum; fruit capsular or berry ; seeds albuminous ...	*Scrophulariaceae*
	Ovules few, superposed; fruit drupaceous or capsular; seeds exalbuminous ...	*Pedaliaceae*
26	Leaves without oil glands; ovary entire; style terminal ...	*Verbenaceae*
	Leaves with oil glands; ovary 4–lobed; style gynobasic ...	*Labiatae*

c. APETALAE (Monochlamydeae)

1	Flowers bisexual* ... (**Exception :** * Flowers unisexual in *Piper* of *Piperaceae* and *Litsaea* of *Lauraceae*)	
	Flowers unisexual ...	14
2	Ovary superior, 1–celled ...	3
	Ovary inferior ...	11
3	Anthers opening by valves; aromatic plants	*Lauraceae*
	Anthers not opening by valves ...	4

4	Leaves stipulate	...	5
	Leaves exstipulate	...	6
5	Stipules sheathing (ochraceous); perianth coloured; plants not aromatic	...	*Polygonaceae*
	Stipules not sheathing; perianth often absent; plants aromatic	...	*Piperaceae*
6	Plants covered with silvery scales	...	*Elaeagnaceae*
	Plants not covered with silvery scales	...	7
7	Leaves opposite	...	*Nyctaginaceae*
	Leaves alternate*	...	8
	(**Exception:*** **Leaves opposite in** ***Wickstroemia*** **of Thymelaeaceae)**		
8	Stamens twice the number of perianth lobes	...	*Thymelaeaceae*
	Stamens as many or less than perianth lobes		9
9	Trees	...	*Proteaceae*
	Herbs or shrubs	...	10
10	Perianth scarious	...	*Amaranthaceae*
	Perianth green, herbaceous	...	*Chenopodiaceae*
11	Ovary 4-5 celled	...	*Aristolochiaceae*
	Ovary 1-celled	...	12
12	Parasitic plants	...	13
	Non-parasitic plants; perianth accrescent; ovule 1, pendulous	...	*Hernandiaceae*
13	Parasitic on stems; ovule 1, erect	...	*Loranthaceae* (Loranthus)
	Parasitic on roots; ovules 2-5, pendulous	...	*Santalaceae*
14	Flowers in catkins or spikes	...	15
	Flowers not in catkins or spikes* (**Exception:*** *Morus*)	...	18

15	Branchlets jonted, cylindrical, cladode ...	*Casuarinaceae*
	Branchlets not jointed; leaves simple, stipulate ...	16
16	Flowers dioecious; ovary superior; seeds hairy ...	*Salicaceae*
	Flowers monoecious; ovary inferior; seeds not hairy ...	17
17	Ovary 2-celled; ovule 1 in each cell ...	*Betulaceae*
	Ovary 3-6 celled; ovules 2 in each cell ...	*Fagaceae*
18	Ovary 1-celled; ovule 1 ...	19
	Ovary 3-celled; ovule 1-2 in each cell ...	*Euphorbiaceae*
19	Leaves opposite, exstipulate, or absent; ovary inferior; parasitic plants ...	*Loranthaceae* (Viscum)
	Leaves alternate; ovary superior; non-parasitic plants ...	20
20	Leaves gland-dotted, exstipulate; endosperm ruminate ...	*Myristicaceae*
	Leaves not gland-dotted, stipulate; endosperm absent ...	21
21	Stipules persistent ...	22
	Stipules deciduous ...	23
22	Stipules intra-petiolar ...	*Ulmaceae*
	Stipules lateral ...	*Cannabinaceae*
23	Leaves with 3 basal ribs; cystoliths absent	*Urticaceae*
	Leaves not as above; cystoliths appearing as dots; milky juice present ...	*Moraceae*

II. Monocotyledons

1	Ovary inferior ...	2
	Ovary superior ...	5
2	Flowers irregular, bisexual: ovules many ...	3
	Flowers regular ...	4
3	Placentation parietal ...	*Orchidaceae*
	Placentation axile ...	*Scitamineae*

4	Flowers bisexual; ovary 3-celled; ovules many	... *Amaryllidaceae*
	Flowers unisexxual; usually climbing plants	... *Dioscoreaceae*
5	Flowers bisexual	... 6
	Flowers unisexual	... 9
6	Flowers arranged in spikelets, often glumaceous; fruit a caryopsis	... 8
	Flowers arranged not in spiketets	... 7
7	Ovary 3-celled	... *Liliaceae*
	Ovary 1-celled	... *Juncaceae*
8	Leaf-sheath entire; stem 3-angled; flower subtended by a single glume	... *Cyperaceae*
	Leaf-sheath split; stem round; flower subtended by several glumes	... *Gramineae*
9	Trees or shrubs (woody)	... *Palmae*
	Herbs or shrubs; flowers in spadices	... 10
10	Plants dioecious	... *Pandanaceae*
	Plants monoecious	... *Araceae*

B. GYMNOSPERMS

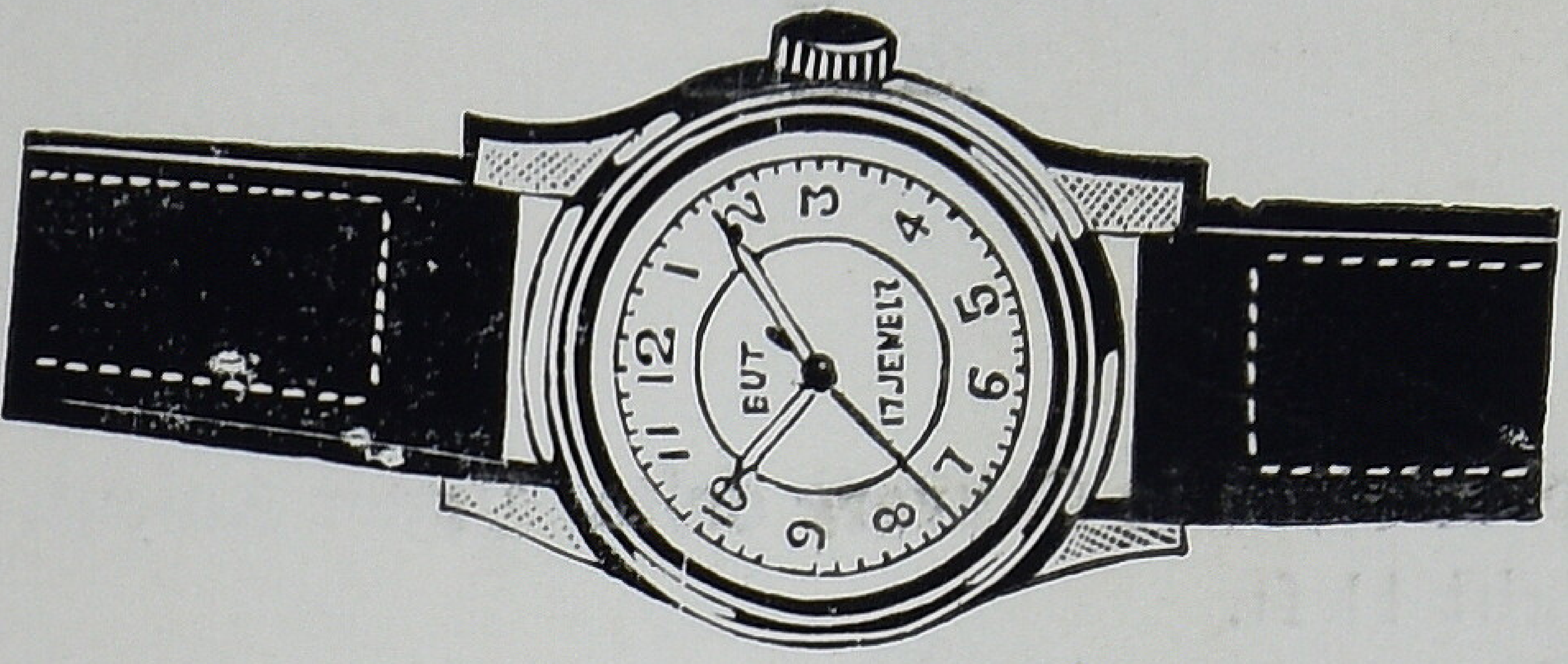
1	Stem jointed; leaves opposite, minute or broad	... *Gnetaceae*
	Stem not jointed	... 2
2	Leaves simple, alternate or fascicled, acicular or linear	... *Coniferae*
	Leaves pinnate, rigid in terminal tufts	... *Cycadaceae*

REFERENCES:

1 Gamble, J. S. .. 1915–1935 Flora of the Presidency of Madras; Part I-XI, London.

2 Gupta, B L. .. 1928 Forest Flora of the Chakrata, Dehra Dun and Saharanpur Forest Divisions, Uttar Pradesh.

3 Mayuranathan, P. V. ... 1929 The Flowering plants of Madras City and its immediate neighbourhood; Bull. Madras Govt. Museum **2**: 1-345.



TIME IS LIFE.

Time is the measure of business as money is of ware.

—Francis Bacon.

Time was created as an image of Eternity.

—Plato.

The time that bears no fruit deserves no name.

—Young.

Time is the stuff life is made of.

—Ben. Franklin.

There is no better test of a man's than time.

—Simonides.

FOR LATEST

WATCHES, CLOCKS & TIME-PIECES

PLEASE VISIT

M/s. GLOBE WATCH CO.

HEAD OFFICE:
215/16, Devaraja Mudali Street,
MADRAS-3.

BRANCH:
14/269, Oppanakara Street,
COIMBATORE.

Phone No. **904**

CONTENTS.

Page.

Cover Photo:

1957 Teak plantation in Cauvery delta, Upper Anicut,
Max, height 11 ft.
—Photo (9—2—58) by Shri T. R. Somasundaram.

1. **About Ourselves** 51

2. **Our wild Life and its Preservation** 58
—by Shri M. Krishnan

3. **Ecology of Natural Grasslands** 64
—by Shri S. V. Venkataramanan

4. **Elite Thinnings in Madras State** 76
—by Shri T. K. Rajagopalan

5. **Geography in The Economic Planning of India** 82
—by Shri D S. Raghuvanshi

6. **An Artificial key to the Identification of some important families of South Indian Flowering (Phanerogamic) Plants** ... 87
—by Shri T. R. Somasundaram

Printed at the Literary Sun Press, Coimbatore.
Published by the Principal, Southern Forest Rangers College, Coimbatore.